

**YUGO
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**SERVICE
MANUAL**

YUGO AMERICA, INC.

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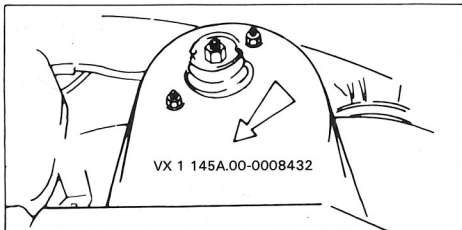
GENERAL INFORMATION

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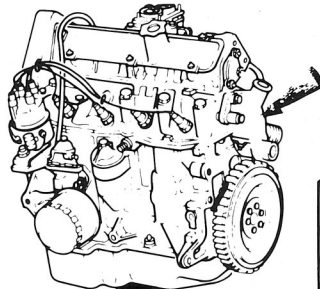
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IDENTIFICATION DATA

Body Type and Number

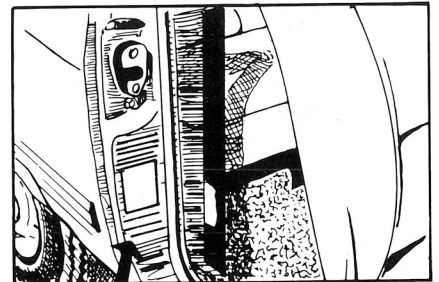


Engine Type and Number

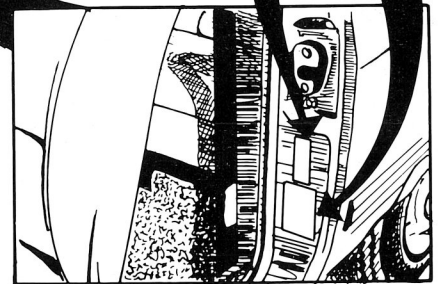


VIN Tag

VX 1BA 1217 HK 337445

Emission
Control
InformationTire and
Weight
Information

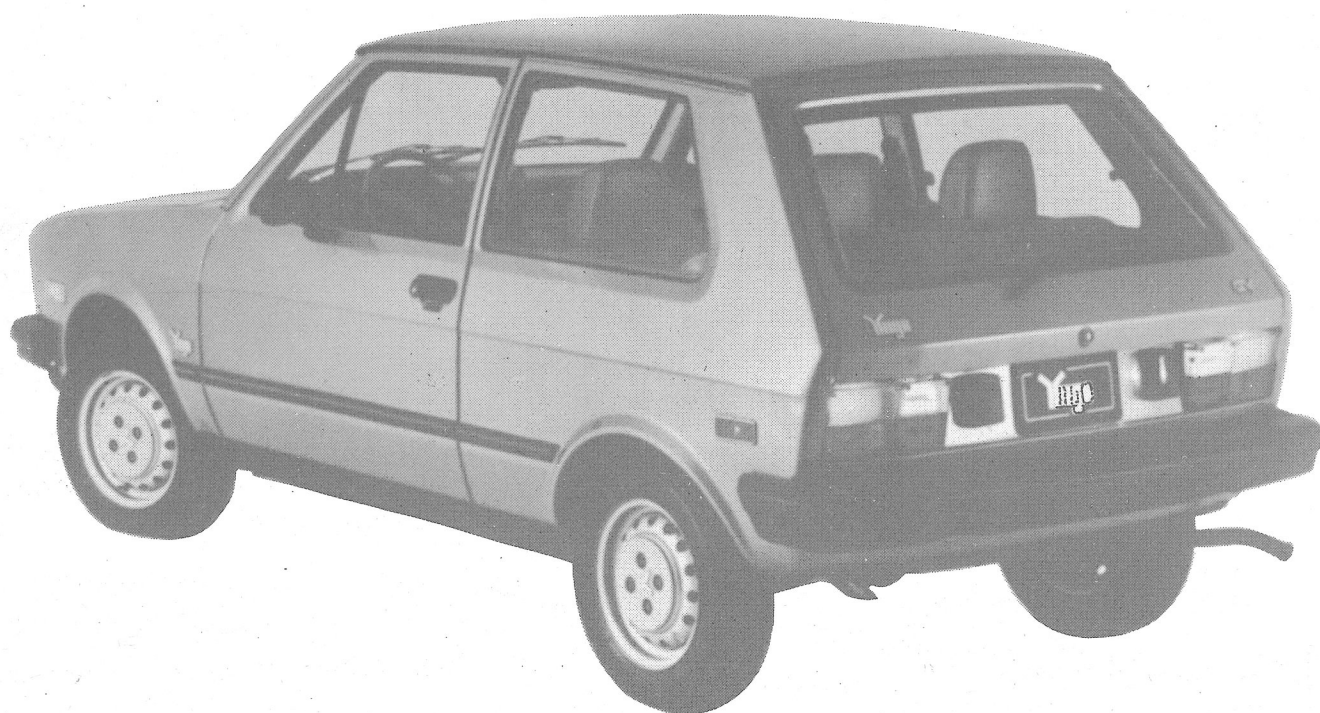
VIN

Tag showing car,
and engine data

ZAVODI CRVENA ZASTAVA			
★	VX 1145A00	★	*
	1220	kg	
	2020	kg	
1	-	620	kg
2	-	620	kg
MOT.-ENG.	128A.064	★	**
VERZ.VERS.	145AB.164		
BR.REZ.D.	-N° FOR SPAR		

*) Position of chassis number

**) Position of engine number



SPECIFICATIONS

ENGINE

Engine type	128 A. 064		128 A6. 064	
Chassis type	VX 1 145 A 00		VX 1 145 A 00	
Arrangement	front, transverse		front, transverse	
Inclination	20°, forward		20°, forward	
Cycle	4 stroke, Otto		4 stroke, Otto	
No. of cylinders in line	4		4	
Bore	3,150 in	80 mm	3.401 in	86,4 mm
Stroke	2.185 in	55,5 mm	2.180 in	55,375 mm
Displacement	68,12 cu.in.	1116 cm ³	79.28 cu.in.	1298,65 cm ³
Compression ratio	9,2		9,1	
Maximum power (DIN)	55 HP	40,4 KW	60.3 HP	45 KW
Engine speed at max. power	6000 r.p.m.		5000 r.p.m.	
Maximum torque (DIN)	52 Ft.Lb.	70,5 Nm	64.73 Ft.Lb.	87,76 Nm
Engine speed at max. torque	4600 r.p.m.		3000 r.p.m.	

TIMING:

Valves in cylinder head.

Camshaft in cylinder head driven by toothed belt.

Clearance between camshaft lobes and valve lifters.

Tappet clearance (with cold engine):

— intake valve016 in	0,40 mm
— exhaust valve019 in	0,50 mm

Intake valves:

— initial opening before TDC	12°
— complete closing after BDC	52°

Exhaust valves:

— initial opening before BDC	52°
— complete closing after TDC	12°

FUEL:

Mechanical pump driven by auxiliary shaft.

Dual barrel carburetor, type CARTER - WEBER 740

LUBRICATION

Oil pump	gear type
Oil pump drive	by auxiliary shaft
Oil pressure relief valve	in oil pump
Full-flow oil filter, with by-pass valve for cutting out filter in case of clogging	cartridge type
Low oil pressure indicator sending unit	electric
Oil pressure, with oil at 212°F (100°C) and min.3000 rpm	50 to 70 psi (3,4 to 4,9 bar)

COOLING SYSTEM

Water pump type	centrifugal
Radiator core	tubular
Radiator fan control	thermostatic switch
Water temperature gauge	electric
Controlled by-pass thermostat for water circulation: — opens at a water temperature of	176 to 183°F (80 to 84°C) 353 to 375 K

CLUTCH

Type	dry, single disc
Pressure plate mechanism	diaphragm spring
Disengagement control	cable operated
Clutch pedal free travel	1 in (25 mm)

TRANSMISSION

No. of gears	4 forward, reverse	5 forward, reverse
Synchronized for 1 - 2 - 3 - 4 gear	existing	existing
Gear ratio:		
— first	3.583	4.090
— second	2.235	2.235
— third	1.454	1.469
— fourth	1.042	1.403
— fifth	—	0.862
— reverse	3.714	3.714

DIFFERENTIAL

Arrangement	enclosed in the gearbox
Differential gear ratio	3.76
Drive to front wheels	axle shafts with constant speed joints (Tripod type at differential, ball type at wheels).

BRAKES

Front brakes	disc type
Rear brakes	drum type: self-centering shoes with automatic clearance adjustment
Hydraulic installation	divided into two independent circuits for front and rear wheels
Proportioning valve	acting on circuit for rear brakes
Hand brake	acts mechanically on rear wheel brake shoes

STEERING

Type	rack and pinion
Steering ratio:	
— steering wheel turns, lock to lock	3,40
— rack travel (nominal value)	5.118 in (130 mm)

FRONT SUSPENSION

Type	independent, with lower swing arms, Mc Pherson struts and sway bar.
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REAR SUSPENSION

Type	independent, with lower swing arms, transverse leaf spring and hydraulic shock absorbers.
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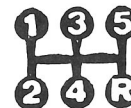
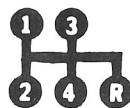
WHEELS AND TIRES

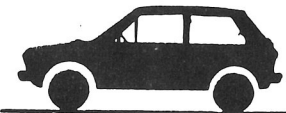





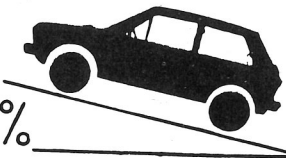





Disc type wheel rim, type	4 1/2 J x 13 in
Tires with radial carcass, type	145 SR x 13 in
Tire pressure	
—front	24 p.s.i. (1,7 bar)
— rear	24 p.s.i. (1,7 bar)
—rear, fully loaded	27 p.s.i. (1,9 bar)

ELECTRICAL

Voltage	12 V
Battery, capacity (at discharging rate of 20 h):	45 Ah
Spark plugs	
Type M. Marelli	CW 7LPR
Champion	RN9Y
Bosch	WR7D
Bosna	FE 65P and FE 65 CPR
Gap028 to .032 in (0,7 — 0-8 mm)

PERFORMANCE

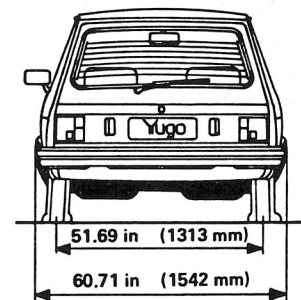
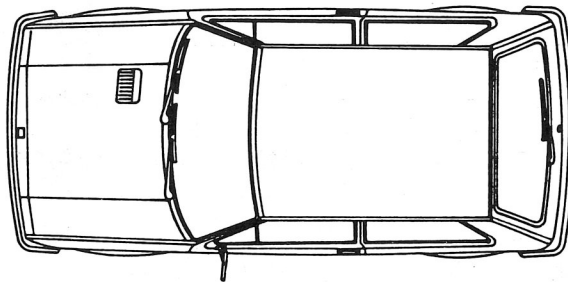
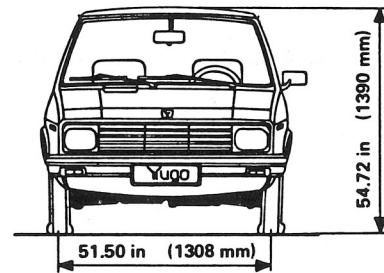
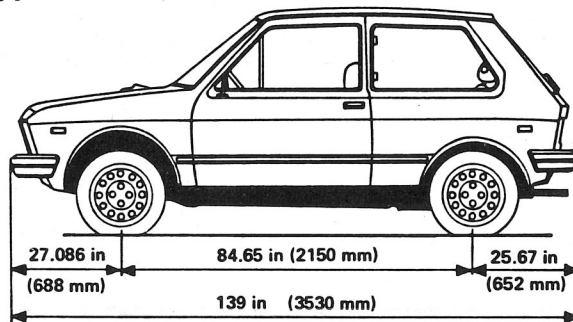


		mph	km/h	mph	km/h
SPEED 		31	50	25	40
		50	80	44	70
		78	125	65	105
		90	145	99	154
		—	—	98	153
MAXIMUM CLIMBING GRADIENTS 	% GRADE				
		30		40	
		17		20	
		10		12	
		6		7	
		—		5	

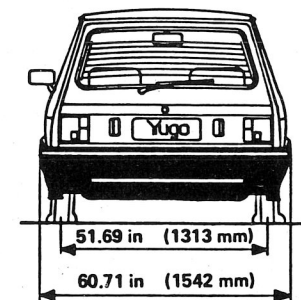
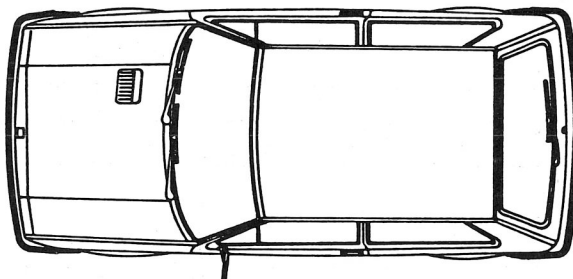
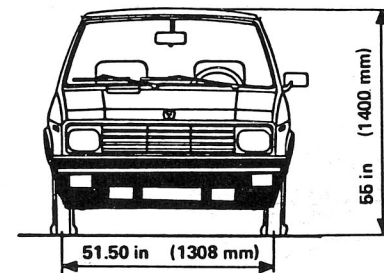
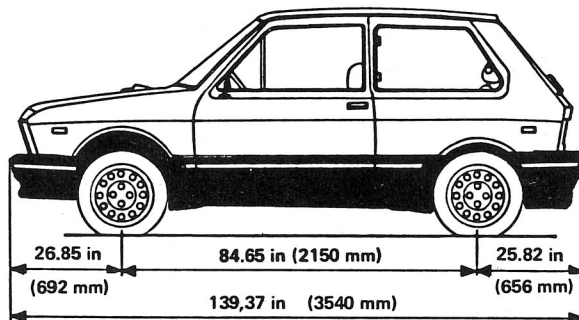
	Lbs	kg	Lbs	kg
WEIGHTS				
Curb Weight	1832	830	1900	865
Gross Vehicle Weight	2604	1180	2680	1215
Maximum Front Axle Load	1368	620	1420	645
Maximum Rear Axle Load	1236	560	1260	570
Four passengers and cargo	772	350	772	350

DIMENSIONS

YUGO GV



YUGO GVX



(*) Maximum height (unloaded)

CAPACITIES

UNIT	QUANTITY			REFILL
	lt	kg	U.S. Units	
Fuel tank	32	—	8,4 gals.	Unleaded gasoline with 87,pump octane
Radiator, cylinder jackets and heating system	6,5	—	6.9 qts.	Use 50-50 antifreeze and water mixture
Engine pan and filter (*)	4,25	3,825	4,5 qts.	Low-ash Detergent Oils - API Service SF — CC To MIL — L — 46152, and above CCMC Sequence.
Transmission oil	3,15	2,85	3,35 qts.	Low-ash Detergent Oils - API Service SF — CC To MIL — L — 46152, and above CCMC Sequence. Single grade SAE 40
Steering box oil	0,14	0,127	0,15 qts.	Lithium base Grease with molybdenum disulphide to N. L. G. I. 000
Constant velocity joint grease (each)	—	0,095	0,21 Lbs	Lithium base Grease with molybdenum disulphide to N. L. G. I. № 2
Hydraulic brake circuits	0.315	—	0,34 qts.	DOT 3 motor vehicle brake fluid to F.M.V.S. No. 116
Windshield and rear window reservoirs	Temperature		Solvent in bottle	
	above 32°F (0°C) down to 14°F (—10°C) below 14°F (—10°C)		3% 50% 100%	Pure water plus high quality windshield washer solvent
Engine oil usage, temperature	Single grade		Multigrade oil	
	Below 5°F (—15°C) 5°F (—15°C) to 32°F (0°C) 32°F (0°C) to 95°F (35°C) Above 95°F (35°C)		(SAE 10W) (SAE 20W) (SAE 30) (SAE 40)	— VS 20 W — 40 (SAE 20 W — 40) VS 20 W — 40 (SAE 20 W — 40) VS 20 W — 40 (SAE 20 W — 40)

(*) Total capacity including sump, filter and lines is 4,8 qts. Amount indicated in table is the requirement for periodic oil changes.

ENGINE

ENGINE

YUGO GV

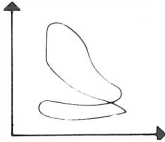
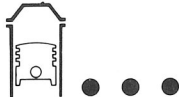

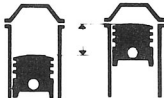
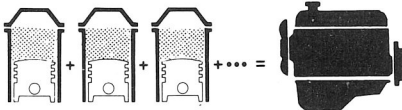
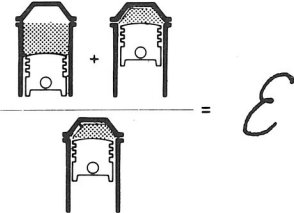
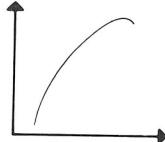

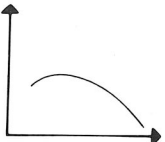
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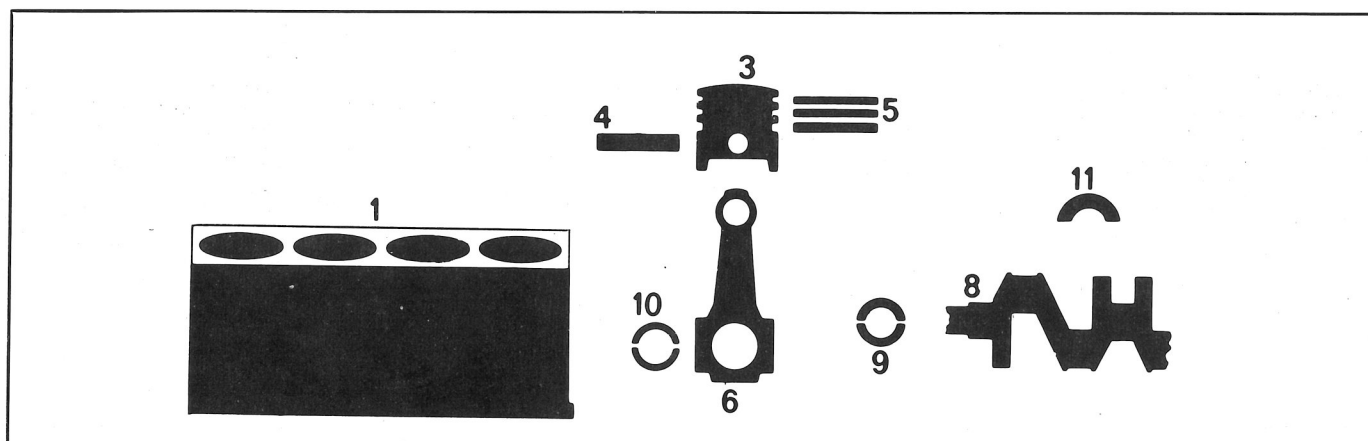
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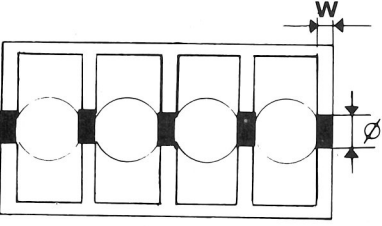
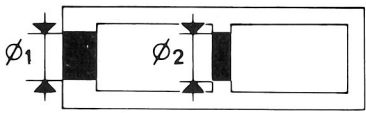

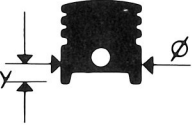
YUGO GVX



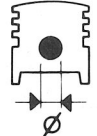







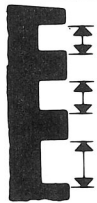

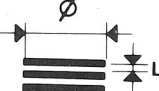


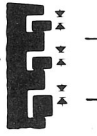


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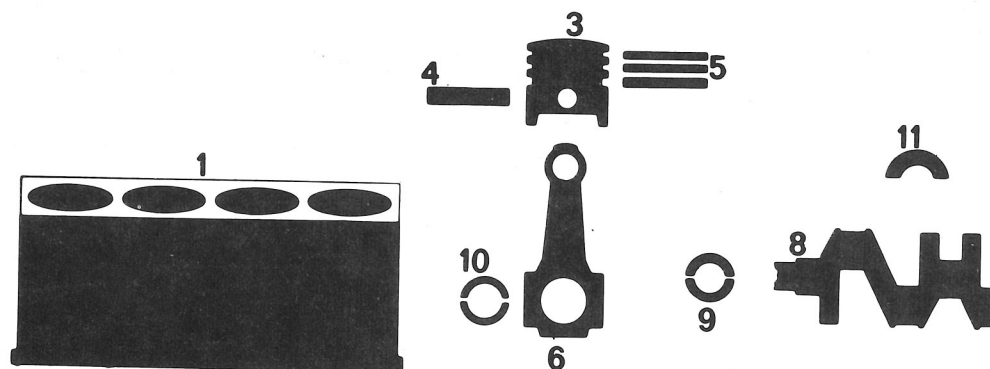
SPECIFICATIONS

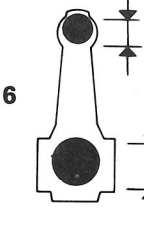

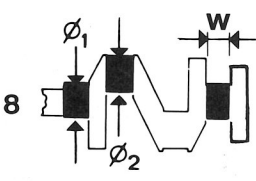
	CYCLE	OTTO FOUR STROKE	
	No. of CYLINDERS	4	
	BORE	3.150 in	80 mm
	STROKE	2.185 in	55,5 mm
	TOTAL CAPACITY	68,12 cu. in	1116 cm ³
	COMPRESSION RATIO	9,2	
  	MAX. OUTPUT DIN	55 HP	40,4 kW
		6000 r.p.m.	
		52 Ft. Lb.	70,5 Nm
	MAX. TORQUE	4600 r.p.m.	

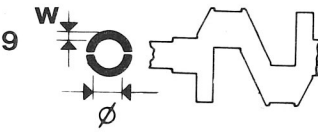

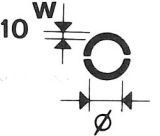

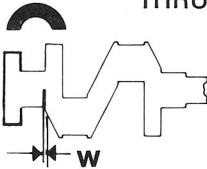



 CYLINDER BLOCK	W	in	mm
		.8716 — .8740	22,140 — 22,200
 AUXILIARY SHAFT BUSHING SEATS	Ø	2.1459 — 2.1464	54,507 — 54,520
	Ø ₁	1.5236 — 1.5248	38,700 — 38,730
	Ø ₂	1.3794 — 1.3805	35,036 — 35,066
 CYLINDERS	Ø (0,010)	3.1496 — 3.1516	80,000 — 80,050
 PISTONS	Y	.875	22,2
	A	3.1481 — 3.1486	79,963 — 79,976
	B	3.1485 — 3.1490	79,973 — 79,986
	C	3.1489 — 3.1494	79,983 — 79,996
	D	3.1493 — 3.1498	79,993 — 80,006
	E	3.1497 — 3.1502	80,003 — 80,016
	Ø O/S	.008 — .016 — .024 .031	0,2 — 0,4 — 0,6 — 0,8

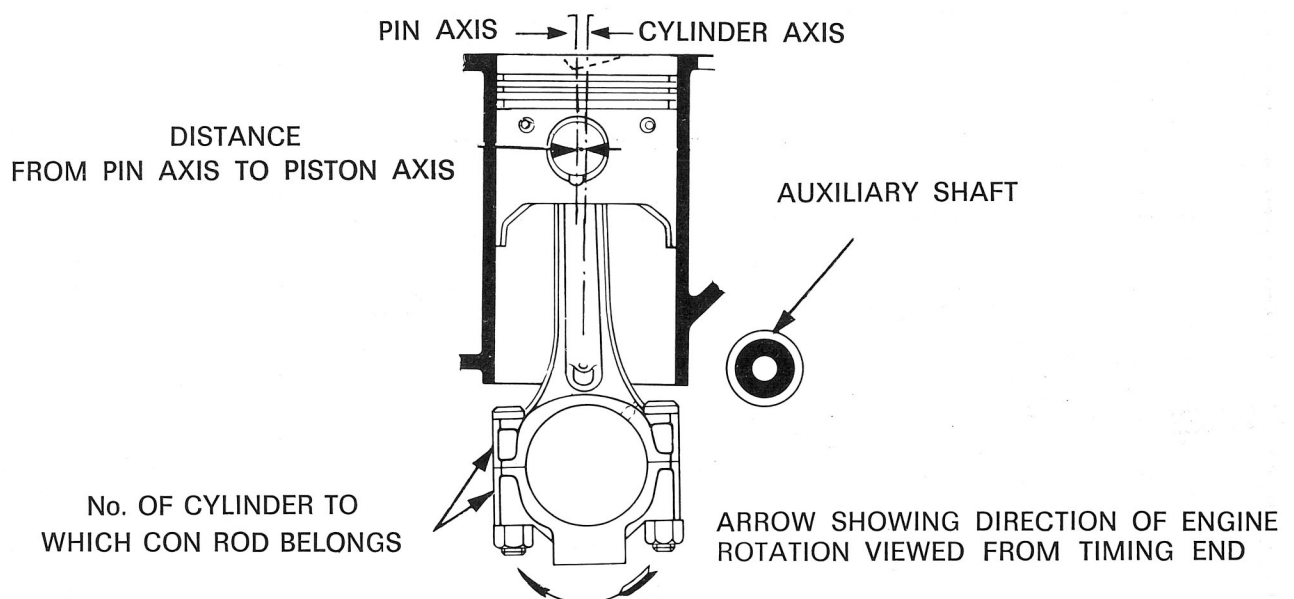
3	 PISTON WEIGHT DIFFERENCE		in	mm
			$\pm 0,088$ oz.	$\pm 2,5$ gr
3-1	 PISTON — CYLINDER		.001 — .002	0,024 — 0,047
3	 PISTON PIN SEAT ϕ 		.8656 — .8658	21,986 — 21,992
4	  ϕ  ϕ 		.8651 — .8653	21,974 — 21,978
	PISTON PIN ϕ O/S		.0079	0,2
4-3	 PISTON PIN — PIN SEAT		.00031 — .00071	0,008 — 0,018
3	 PISTON GROOVES 	1	.0604 — .06122	1,535 — 1,555
		2	.0793 — .0801	2,015 — 2,035
		3	.1558 — .1566	3,957 — 3,977
5	  ϕ  L	1	.0582 — .0587	1,478 — 1,490
		2	.0779 — .0783	1,978 — 1,990
		3	.1545 — .1553	3,925 — 3,937
	PISTON RINGS ϕ O/S		.0079 — .0157 — .0236 — .031	0,2 — 0,4 — 0,6 — 0,8
5-3	 PISTON GROOVES — PISTON RINGS 	1	.0018 — .0030	0,045 — 0,077
		2	.0001 — .0022	0,025 — 0,057
		3	.0008 — .0019	0,020 — 0,052
5-1	 	1	.0118 — .0177	0,30 — 0,45
		2	.0079 — .0140	0,20 — 0,35
	PISTON RING GAP, FITTED IN CYLINDER. 3		.0079 — .0140	0,20 — 0,35

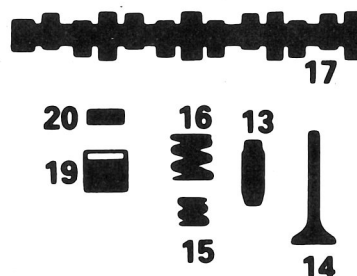
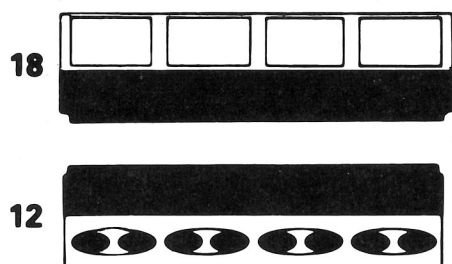



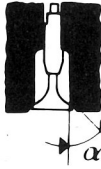
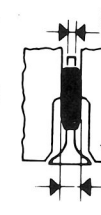
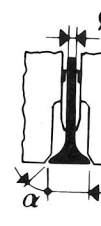
	in		mm
	.8638 — .8646		21,940 — 21,960
	1.9146 — 1.9152		48,630 — 48,646
	PISTON PIN	.0006 — .0015	0,014 — 0,038
CON ROD SMALL END	MUST BE INTERFERENCE FIT IN THE RANGE SPECIFIED		
	MAIN BEARING JOURNAL ϕ_1	1.9994 — 2.0002	50,785 — 50,805
	ROD BEARING JOURNAL ϕ_2	1.7913 — 1.7920	45,498 — 45,518
	W	1.0620 — 1.0640	26,975 — 27,025


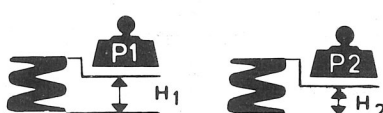
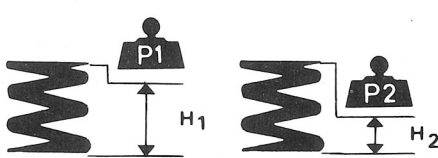
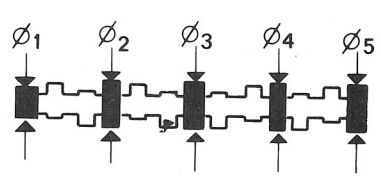



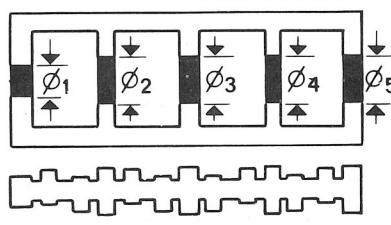

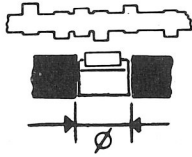
BEARINGS			in	mm
	W		.0718 — .0721	1,825 — 1,831
	ϕ O/S		.005 - .010 - .020 - .030 - .040	0,127 - 0,254 - 0,508 - 0,762 — 1,016
			.0016 — .0033	0,040 — 0,085
9-8  MAIN BEARINGS				
	CON ROD BEARINGS	W	.0603 — .0606	1,531 — 1,538
		ϕ O/S	.005 - .010 - .020 - .030 - .040	0,127 - 0,254 - 0,508 - 0,762 — 1,016
			.0014 — .0034	0,036 — 0,086
10-8  ROD BEARINGS				
	THRUST BEARING	W	.0909 — .0929	2,310 — 2,360
		O/S	.005	0,127
			.0021 — .0104	0,055 — 0,265
11-8  THRUST BEARING-CRANKSHAFT				

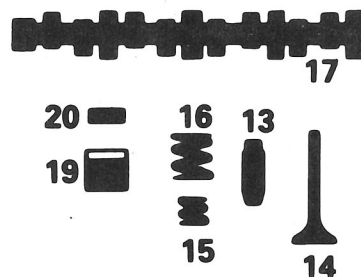
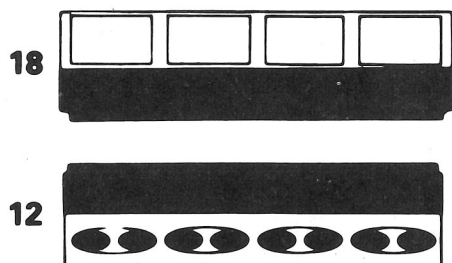
PISTON ROD ASSEMBLY IN CYLINDER BORE



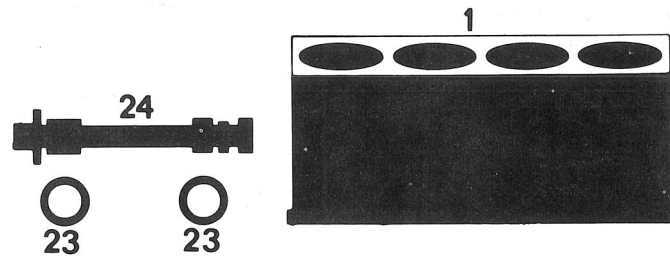


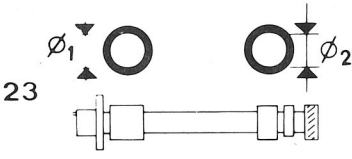
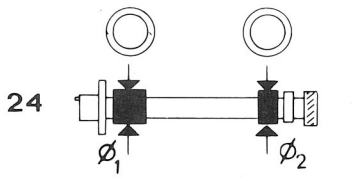


			in	mm
	VALVE GUIDE BORES	Ø	.5492 — .5499	13,950 — 13,977
	VALVE SEATS	α	$45^{\circ} \pm 5'$	
		w	$45^{\circ} \pm 5'$	
	VALVE GUIDES	Ø ₁	.3158 — .3165	8,022 — 8,040
		Ø ₂	.5527 — .5534	14,040 — 14,058
		Ø O/S	.0079	0,20
12 - 13	VALVE GUIDES - HEAD		.0025 — .0043	0,063 — 0,108
	VALVES	Ø ₁	.3139 — .3146	7,974 — 7,992
		Ø ₂	1.181	30
		α	$45^{\circ}30' \pm 5'$	
		Ø ₁	.3139 — .3146	7,974 — 7,992
		Ø ₂	1.053	26,75
		α	$45^{\circ}30' \pm 5'$	

13 — 14		 VALVE - VALVE GUIDE		in	mm
				.0012 — .0026	0,030 — 0,066
15		P ₁	32,8 Lbs	14,6 ± 0,5 kg	
		H ₁	1.22	31	
		P ₂	62 Lbs	27,6 ± 1,18 kg	
		H ₂	0.846	21,5	
VALVE SPRINGS					
16		P ₁	85,7 Lbs	38,1 ± 1,5 kg	
		H ₁	1.417	36	
		P ₂	128,6 Lbs	58,4 ± 2,45 kg	
		H ₂	1.043	26,5	
VALVE SPRINGS					
17		Ø ₁	1.1787 — 1.1795	29,944 — 29,960	
		Ø ₂	1.8872 — 1.8878	47,935 — 47,950	
		Ø ₃	1.8951 — 1.8957	48,135 — 48,150	
		Ø ₄	1.9030 — 1.9035	48,335 — 48,350	
		Ø ₅	1.9108 — 1.9114	48,535 — 48,550	
CAMSHAFT JOURNAL					
CAM HEIGHT			.362	9,2	
			.364	9.25	
18		Ø ₁	1.1807 — 1.1816	29,909 — 30,014	
		Ø ₂	1.8890 — 1.8900	47,980 — 48,005	
		Ø ₃	1.8968 — 1.8976	48,180 — 48,205	
		Ø ₄	1.9047 — 1.9057	48,380 — 48,405	
		Ø ₅	1.9126 — 1.9136	48,580 — 48,605	
CAMSHAFT BEARINGS					
17 — 18		 CAMSHAFT JOURNAL — CAMSHAFT BEARINGS		.0012 — .0028	0,030 — 0,070
		LIFTER SEATS Ø	1.4567 — 1.4577	37,000 — 37,025	

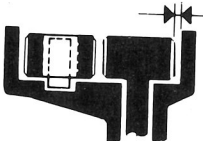
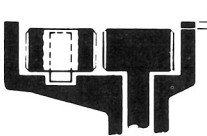
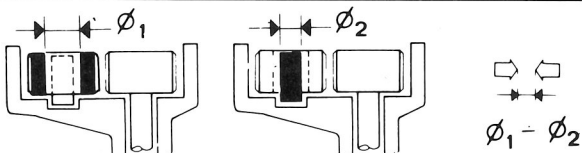
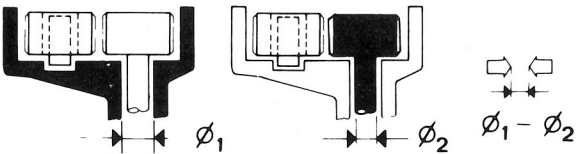




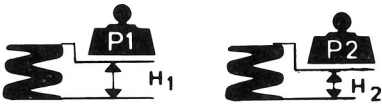


		in	mm
19	LIFTERS	1.4557 — 1.4565	36,975 — 36,995
	19 — 18 LIFTERS — OVERHEAD SEATS	.0002 — .0019	0,005 — 0,050
20	PLATES $s \left(\begin{array}{c} \text{0,05} \end{array} \right)$.128 — .185	3,25 — 4,70
17-20	WORKING CLEARANCE	.016	0,40
		.019	0,50
	FOR VALVE TIMING CHECK	.024	0,60
		.026	0,65
TIMING CHECK ANGLES (°)			
INTAKE	BEGINS TO OPEN T.D.C.	12°	
	FULLY CLOSED AFTER B.D.C.	52°	
	BEGINS TO OPEN BEFORE B.D.C.	52°	
EXHAUST	FULLY CLOSED AFTER T.D.C.	12°	

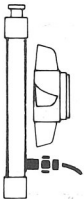





 23 AUXILIARY SHAFT BUSH			in		mm			
			1.4041 — 1.4049		35,664 — 35,684			
 24 AUXILIARY SHAFT JOURNALS			ϕ_1		1.4013 — 1.4023		35,593 — 35,618	
			ϕ_2		1.2574 — 1.2583		31,940 — 31,960	
23-1  BUSH - SEAT IN BLOCK			MUST BE INTERFERENCE FIT					
24-23  SHAFT JOURNAL - BUSH			ϕ_1		.0018 — .0036		0,046 — 0,091	
			ϕ_2		.0016 — .0031		0,040 — 0,080	




LUBRICATION

OIL PUMP		in	mm
		GEAR TYPE	
PUMP DRIVE		BY AUXILIARY SHAFT	
OIL PRESSURE CONTROL VALVE		IN PUMP BODY	
	BETWEEN PUMP BODY AND GEAR	.004 — .007	0,110 — 0,180
	BETWEEN UPPER FACES OF GEAR AND PUMP BODY	.0009 — .0041	0,020 — 0,105
		.0007 — .0022	0,017 — 0,057
		.0006 — .0021	0,016 — 0,055
	BETWEEN GEARS	.0059	0,15
OIL FILTER WITH FULL FLOW		WITH PAPER CARTRIDGE	
  	OIL PRESSURE AT TEMPERATURE OF 212°F (373 K) and min 3000 r.p.m.	50 — 70 psi	3,4 — 4,9 bar (3,5 — 5 kg/sq cm)
	P ₁	10,16 ± 0,33 lbs	45,2 ± 1,5 N
	H ₁	.886	22,5
	P ₂	11,023 ± 0,33 lbs	49 ± 1,5 N
	H ₂	.827	21
PRESSURE RELIEF SPRING			

COOLING SYSTEM

COOLING SYSTEM		LIQUID COOLANT MIXTURE AND CENTRIFUGAL PUMP, THERMOSTAT AT ENGINE OUTLET, ELECTRIC FAN AND SWITCH ON RADIATOR	
PUMP DRIVE		VIA V — BELT	
 FAN MOTOR THERMAL SWITCH		198°F	92°C
		189°F	87°C
THERMOSTAT	BEGINS TO OPEN	180°F	82°C
	FULLY OPEN	205°F	96°C
	VALVE STROKE	.3150	8 mm
GAP BETWEEN IMPELLER AND PUMP BODY			
		.0315 — .0512	0,8 — 1,3 mm
COOLING SYSTEM TEST PRESSURE		12,2 psi	0,98 bar
COOLING SYSTEM OPERATING PRESSURE		11,4 psi	0,78 bar

FUEL SUPPLY

FUEL PUMP	MECHANICAL — DIAPHRAGM TYPE	
OUTPUT	19,8 gal/hr.	75 L/hr.
   PRESSURE AT 4 000 r.p.m.	2,55 psi	0,176 Bar

TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Torque		
		Ft. Lb.	Kgm	Nm
Main bearing cap bolt	M 10 x 1,25	59	8,2	80
Connecting rod cap nut	M 9 x 1	38	5,2	51
Flywheel bolt	M 10 x 1,25	61	8,5	83
Cylinder head bolt	M 12 x 1,25	69	9,5	93
Cylinder head bolt	M 10 x 1,25	28	4,1	40
Intake and exhaust manifold nut	M 8	20	2,8	27
Camshaft housing bolt	M 8	14	2	20
Crankshaft pulley nut	M 20 x 1,5	101	14	137
Camshaft sprocket bolt	M 10 x 1,25	61	8,5	83
Tensioner pulley support nut	M 10 x 1,25	33	4,5	44
Alternator upper mounting bracket self-locking nut	M 10 x 1,25	36	5	49
Alternator lower mounting bracket nut	M 10 x 1,25	36	5	49
Alternator lower support nut and bolt	M 10 x 1,25	36	5	49
Water pump upper bracket nut	M 8	18,5	2,5	25
Air pump pulley bolts	M 6 x 1	7,5	1,0	10
Breather pipe-to-crankcase bolt	M 8	18,5	2,5	25
Spark plugs	M 14 x 1,25	27	3,8	37

REMOVAL AND INSTALLATION

The engine removal procedures are described in this section. The engine, transmission, and differential are removed as an assembly by lowering it through the bottom of the engine compartment. Open the hood. Remove the spare tire.

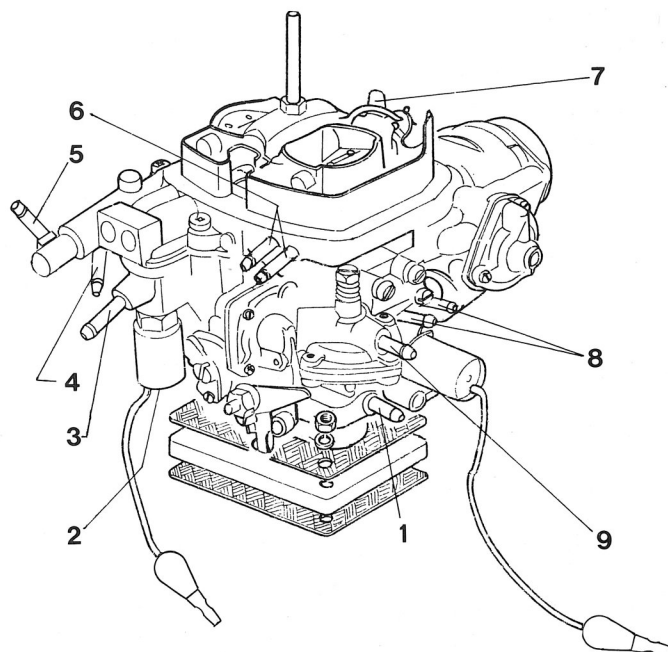
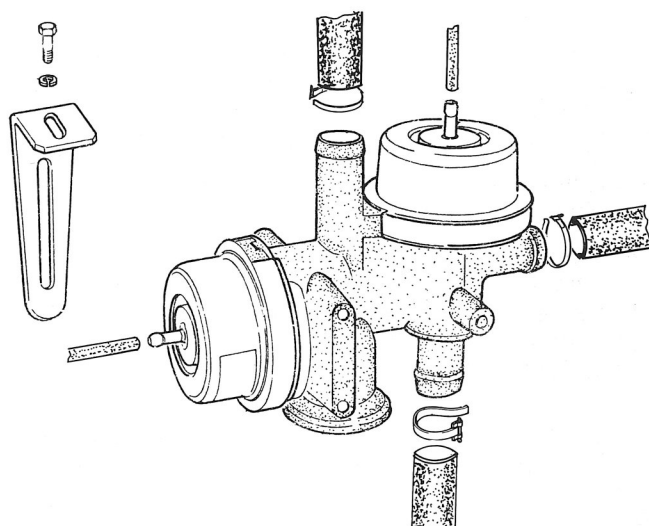
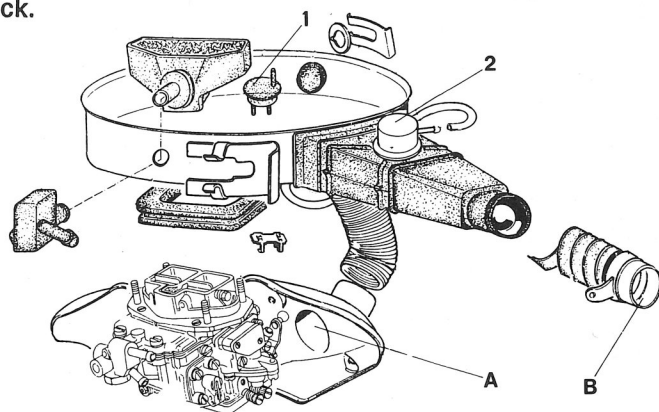
Drain the engine coolant system as follows:

- completely open the heater temperature control lever inside the car;
- open the drain plug at the bottom of the radiator and remove the radiator cap;
- open the drain cock on the side of the cylinder block.
- remove the cap from the expansion tank.

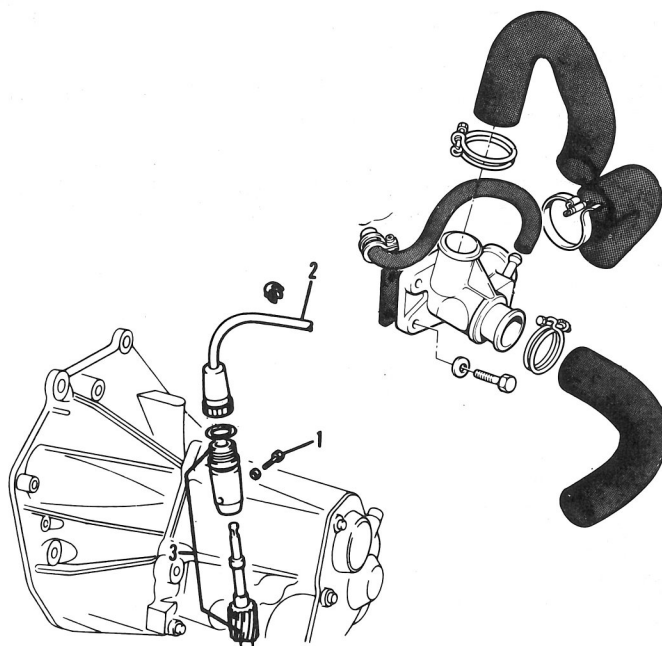
IN THE ENGINE COMPARTMENT:

NOTE: Mark lines, hoses, and wires before removal to identify them for installation. Plug all hoses and connections to prevent dirt entry.

- disconnect the battery cables to avoid short circuits;
- disconnect flexible hose for air cleaner from front of car. Disconnect hoses from bottom of air cleaner. Remove air cleaner housing;
- disconnect the primary and secondary wires from the distributor;
- disconnect wires from the alternator, starter, oil pressure sending unit, water temperature sending unit, and the backup light switch;
- disconnect air hoses and vacuum hose from air injection diverter valve;
- disconnect the accelerator cable from the carburetor;
- disconnect vacuum and fuel evaporative hoses from carburetor and intake manifold;
- disconnect wires from carburetor choke and shut off solenoid;
- disconnect fuel supply and return hoses;
- disconnect the exhaust pipe from the manifold;



- disconnect the two radiator hoses from the thermostat housing;
- disconnect the heater water supply and return hoses from the engine;
- disconnect speedometer cable from the transmission by unscrewing the ring;
- remove the clutch cable from the clutch release lever after unscrewing the locknut and nut;
- attach the fixture A. 60592 to a hoist and line it up with the engine assembly.
- hook the fixture to the engine and place the cable under light tension.



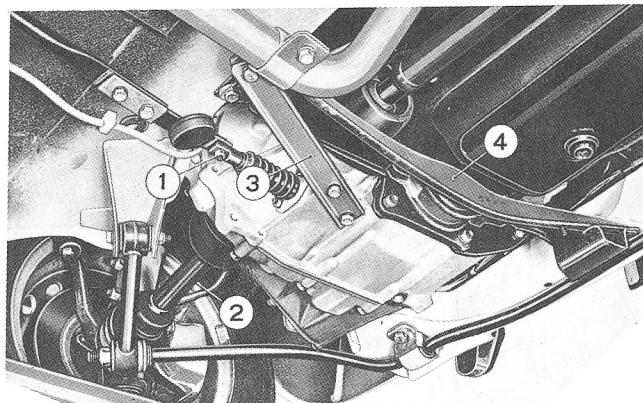
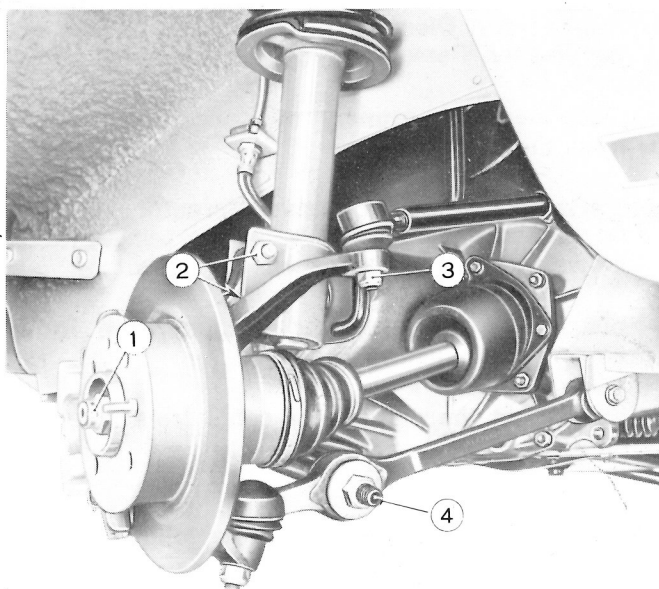
WORKING FROM BELOW THE CAR:

- remove front wheels. Unscrew left tie rod end nut (3) and disconnect tie rod joint using remover A. 47035;
- remove the sway bar by removing the bolts securing the brackets and bushings to the body and unscrew nut (4) securing bar to the control rod; note location and number of shims;
- remove bolts and nuts (2) and remove shock absorber from knuckle;
- remove CV joint nuts (1) from both front wheels. Work the shaft of each CV joint out of its seat in the knuckles. Secure the axle shafts with wire to retain them in their seats in the differential;

1. CV joint nut 2. Shock absorber to knuckle bolts and nuts 3. Tie rod nut 4. Sway bar end;

- remove exhaust pipe support bracket (3) from the transmission housing;
- disconnect the ground strap from the transmission housing;
- remove bolt and nut (1) and disconnect gearshift linkage;
- detach crossmember (4) from the underbody;

1. Gearshift linkage bolt and nut 2. Axle shaft 3. Support bracket 4. Engine support crossmember.



WORKING IN THE ENGINE COMPARTMENT:

- Remove the engine mount bolt.

Using the hoist, lower the engine assembly from the bottom of the car to remove it.

For installing the engine, reverse the order of the removal operations. Be sure to replace any self-locking nut.

After installation is complete, fill the radiator and expansion tank with coolant mixture to between 6 to 7 cm above the MIN mark. Check all fluid levels and connections and start the engine. Check that there are no leaks from all lines and hoses and connections. Check that all control linkages work smoothly.

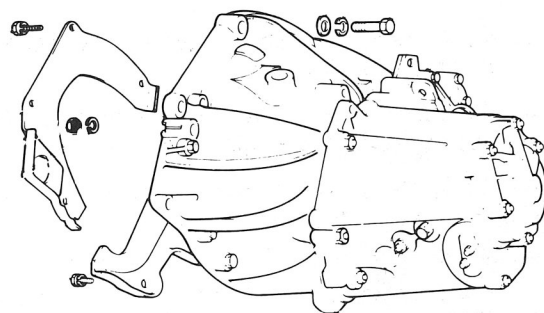
DISASSEMBLY

Place engine assembly on the overhaul stand A. 61000. Place a tray under the engine.

Remove the oil dipstick. Remove oil filter using tool A. 60312. Drain the oil using tool A. 50113.

Remove three bolts and washers and remove the starter.

Remove the bolts, and nuts securing transmission to engine. Remove transmission.

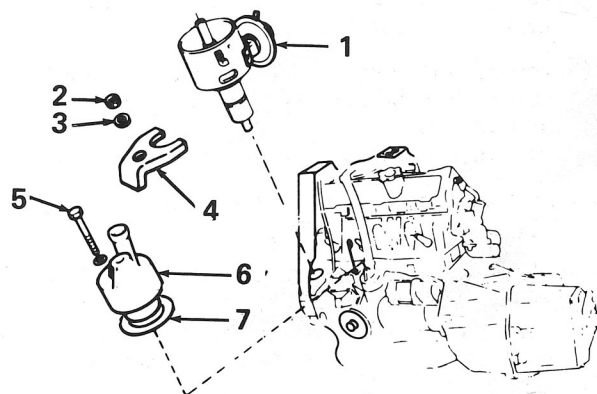


NOTE: If the pressure plate of the clutch is to be reused, mark its position on the flywheel and plate.

Remove the bolts securing the clutch to the flywheel and remove the clutch.

Disconnect the vacuum hose from distributor (1).

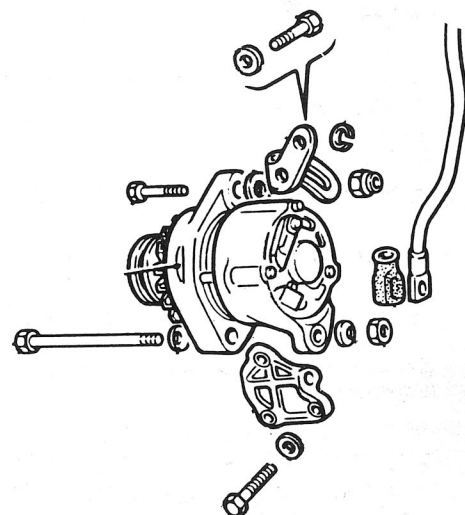
Disconnect the distributor leads from the spark plugs. Remove nut (2), lockwasher (3), and clamp (4) holding distributor (1) in engine. Remove distributor.



Remove bolt (5) from crankcase breather (6) and remove breather and gasket (7) from engine.

Remove the bolts, washers, and nuts securing the alternator to the brackets. Remove the alternator and drive belt.

Remove the bolts and washer securing the alternator mounting bracket to the engine and remove the bracket.



Remove the air hose from the check valve. Remove the bolts and washers securing the air pump. Remove the air pump with attached hoses.

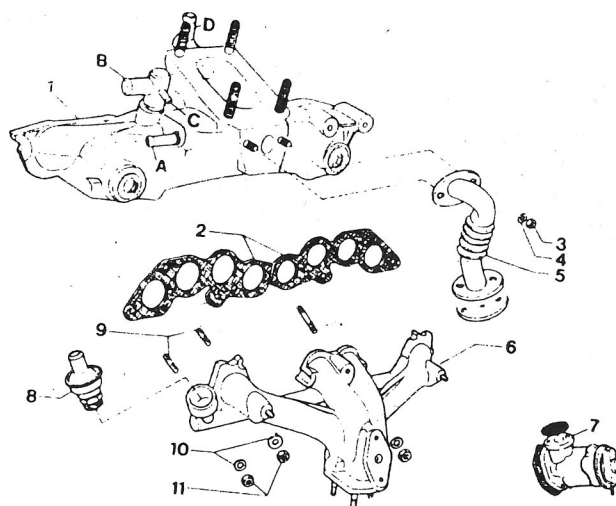
Unscrew and remove the check valve.

Disconnect the EGR tube the intake manifold.

Remove the bolts and washers holding the EGR tube to the EGR valve and remove the tube.

Disconnect the vacuum hose from the EGR valve. Remove the bolts and washers holding the EGR valve and remove the valve and gasket.

Remove the bolts and washers holding the EGR base and remove the base and gasket.

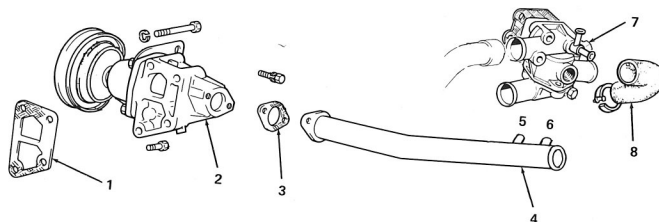


Remove the coolant hoses from the thermostat housing.

Remove the bolts holding the coolant pipe to the water pump and remove the pipe.

Remove the bolts and washers holding the water pump and remove the pump and gasket.

Remove the bolts and washers holding the thermostat housing and remove the housing and gasket.



ENGINE ASSEMBLY

Remove the bolts and washers holding the timing belt cover and remove the cover. Stop engine rotation by installing tool A. 60360 on the flywheel.

Remove camshaft sprocket bolt (9) and auxiliary shaft sprocket bolt (10).

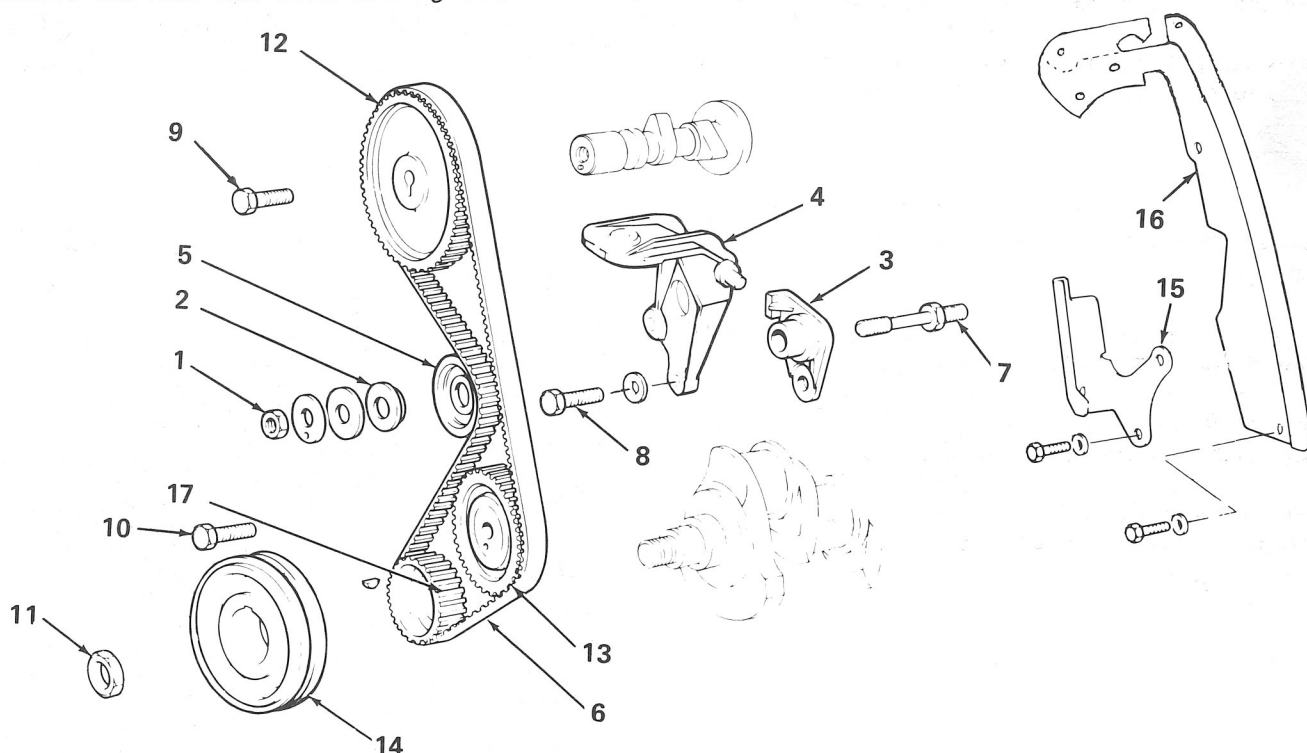
Remove crankshaft pulley nut (11) using wrench A. 50 121.

Remove nut (1), washers, and spacer (2). Press bracket (3) against the tensioner in right engine mount (4) and then remove pulley (5) and timing belt (6). Remove tensioner support bracket (3) from stud (7) and remove stud.

Remove three bolts (8) holding engine mount (4) and remove mount.

Remove camshaft sprocket (12), auxiliary shaft sprocket (13), crankshaft pulley (14), and crankshaft sprocket (17).

Remove the nuts and bolts holding belt shields (15 & 16) and remove shields.



- 1. Nut
- 2. Spacer
- 3. Tensioner support bracket
- 4. Right engine mount
- 5. Tensioner pulley

- 6. Timing belt
- 7. Stud
- 8. Bolt
- 9. Bolt

- 10. Bolt
- 11. Nut
- 12. Camshaft sprocket
- 13. Auxiliary shaft sprocket

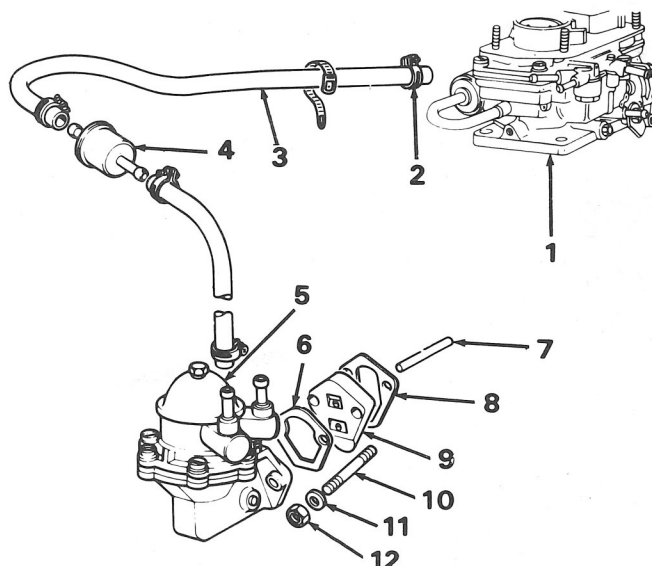
- 14. Crankshaft pulley
- 15. Belt shield
- 16. Belt shield
- 17. Crankshaft

Remove clamp (2) and fuel pump line (3) at carburetor (1). Leave filter (4) and the fuel lines attached to pump (5).

Remove two nuts (12) and washers (11) from studs (10) holding the pump to the engine. Carefully remove the pump from the engine being certain actuating rod (7) is removed. When reassembling, make sure that gaskets (6 & 8) and insulator (9) are installed in the order shown.

NOTE: Gasket (8) comes in three different sizes which are used to adjust the pump stroke (pressure).

- 1. Carburetor
- 2. Clamp
- 3. Fuel hose
- 4. Fuel filter
- 5. Fuel pump
- 6. Gasket
- 7. Actuating rod
- 8. Gasket
- 9. Insulator
- 10. Stud
- 11. Washer
- 12. Nut

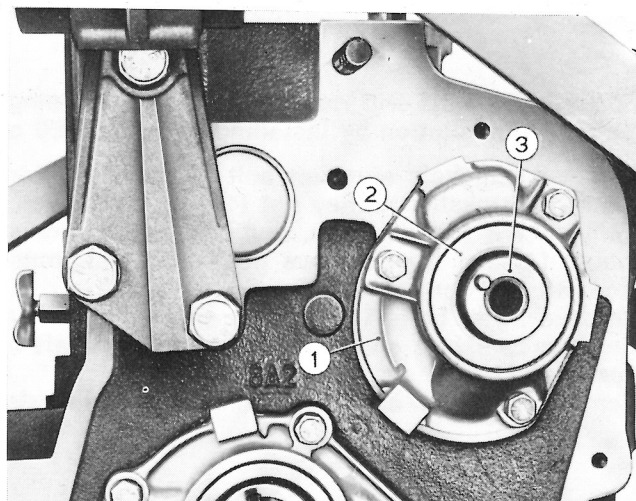


Remove the carburetor.

Remove the cylinder head with the mainfolds and camshaft housing from the crankcase by removing the nuts and bolts holding the cylinder head. Use tool A. 50131/1/2 for the carburetor side nuts.

Remove the cylinder head gasket.

NOTE: When removing the cylinder head with the engine in the car, it is a good idea to leave the intake and exhaust manifolds (along with the carburetor) and the camshaft housing attached to the cylinder head. Removal of these parts is best performed with the cylinder head on the bench. Refer to **CYLINDER HEAD Disassembly**.



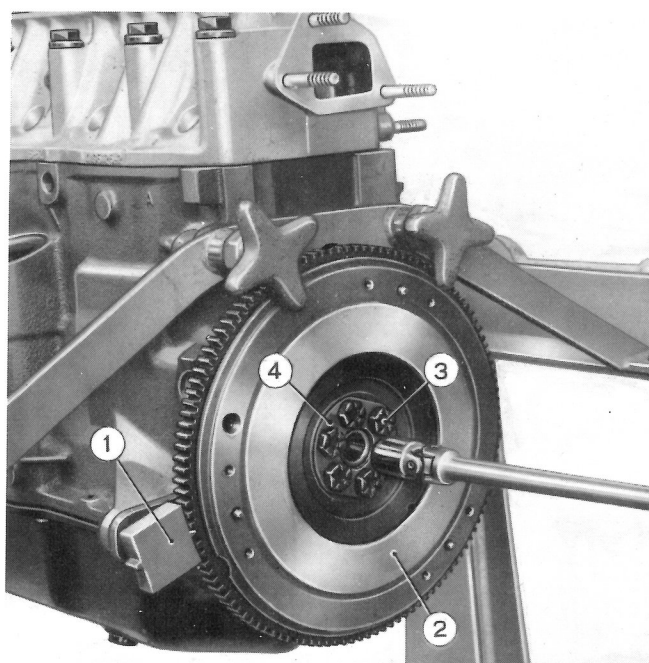
Remove auxiliary shaft cover (1) and seal (2) from the crankshaft and remove shaft (3).

1. Cover 2. Seal 3. Auxiliary shaft

Remove six bolts (3) and washer plate (4) holding flywheel (2) to crankshaft. Remove flywheel.

Turn the engine upside down on the stand. Remove the attachment bolts and washers and remove the oil pan and gasket.

1. Tool A. 60369 2. Flywheel 3. Flywheel to crankshaft bolt 4. Washer plate.



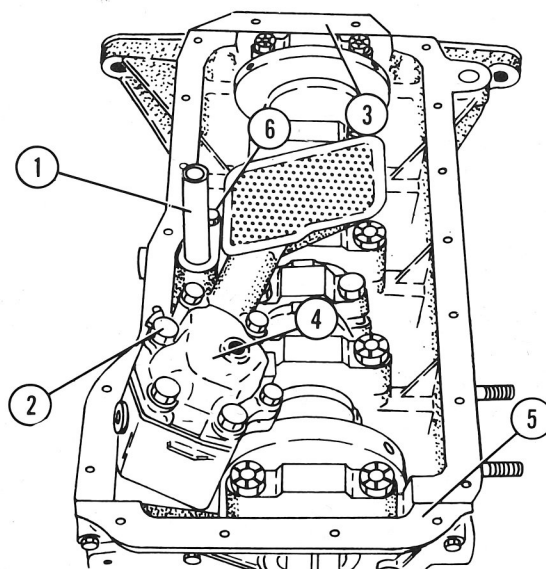
Remove the six bolts and lockwashers holding flywheel end cover plate (3). Remove plate and gasket.

Remove the five bolts and lockwashers holding timing gear end cover plate (5). Remove plate and gasket.

Remove three bolts (2) and lockwashers holding oil pump assembly (4). Remove pump with the oil pick-up tube and gasket.

Remove bolt (6) holding oil return pipe (1) and remove pipe.

1. Oil return pipe 2. Bolt 3. Flywheel end cover plate 4. Oil pump 5. Timing gear end cover plate 6. Bolt.



Remove the connecting rod caps complete with bearing inserts from the crankshaft.

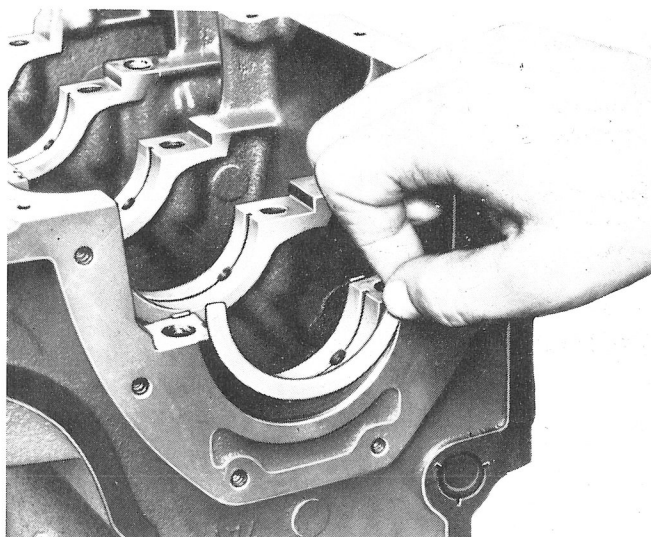
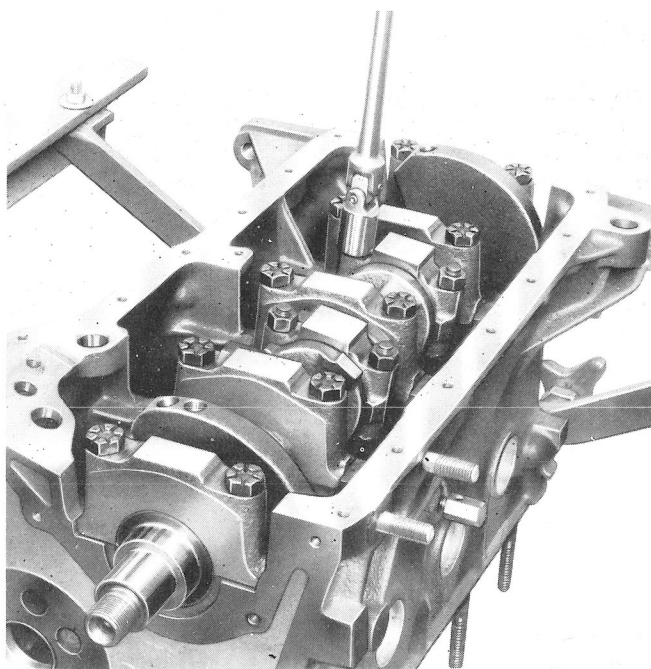
Remove the four piston-rod assemblies from the top of the cylinder block.

NOTE: Turning crankshaft will make this operation easier.

Remove the main bearing caps with the lower bearing inserts.

Remove the crankshaft and take out upper bearing inserts.

Remove the thrust ring halves from the rear main bearing saddle.



ASSEMBLY

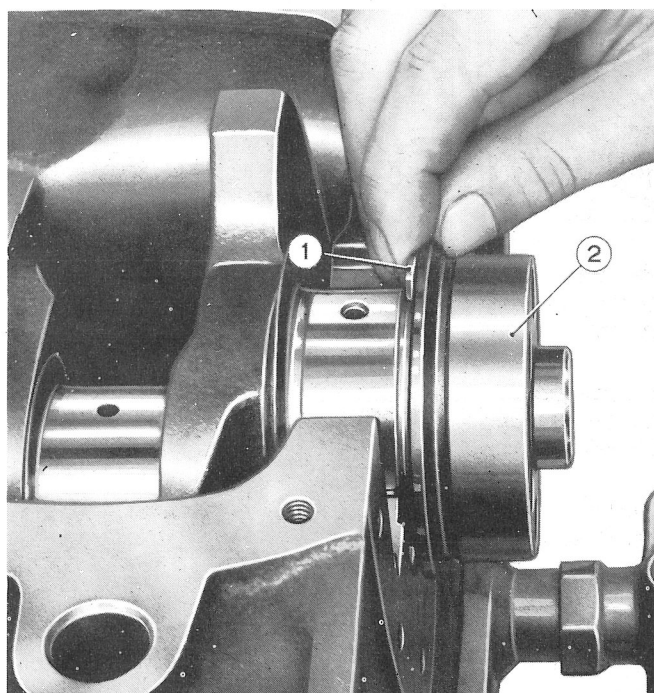
Thoroughly lubricate bearing inserts with clean engine oil.

Put the main bearing inserts into position and install crankshaft (2).

NOTE: Before and during installation of the crankshaft, refer to **CRANKSHAFT AND FLYWHEEL** for procedures and inspections.

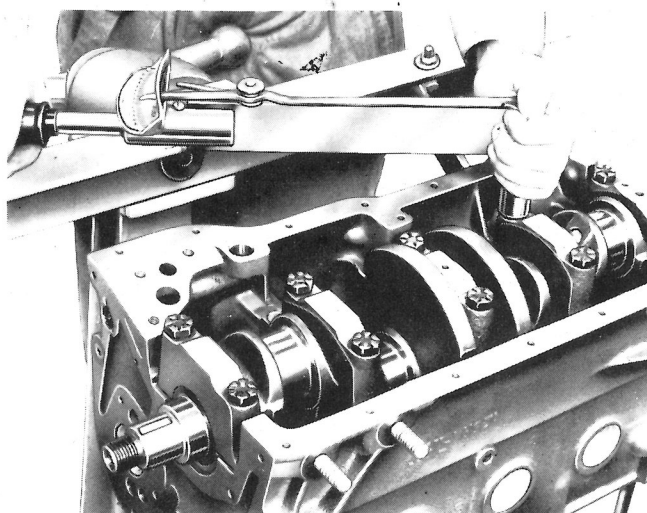
The two thrust ring halves (1) are positioned at the rear main bearing saddle bore. Thrust rings may be installed before or after installing crankshaft.

1. Thrust ring 2. Crankshaft



Install the main bearing caps and bearing inserts.

Make sure the caps are installed at proper location. Cap without a notch is at the timing gear end of the crankcase, then, cap with one notch, etc.

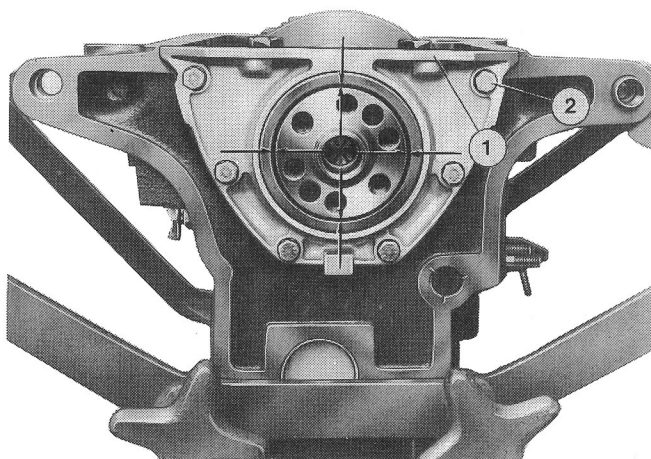


Install a new seal and gasket on flywheel end cover plate (1).

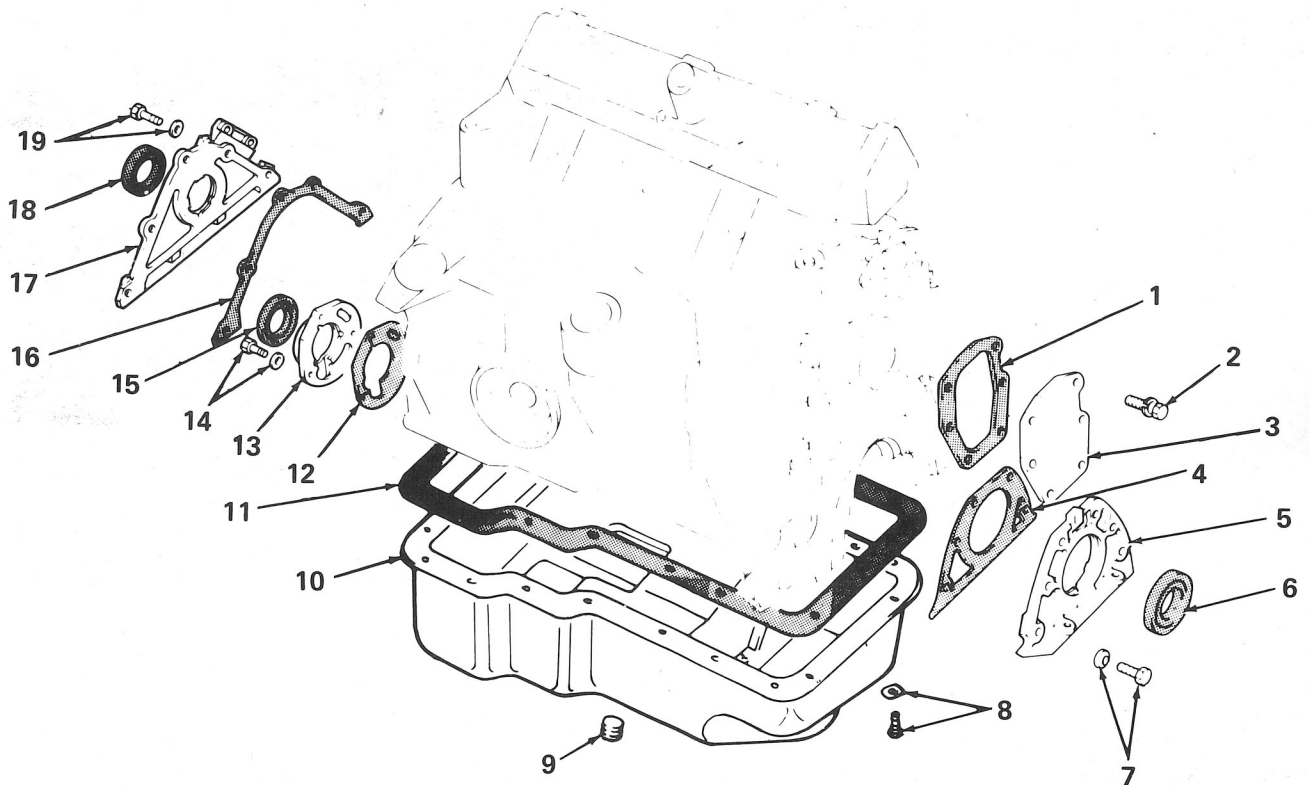
Install the cover to the crankcase with six bolts (2) and lockwashers.

NOTE: Arrows in illustration indicate that with the cover installed, the distance between cover seal and crankshaft should be equal all around.

1. Flywheel end cover plate 2. Bolt



Gaskets and seals



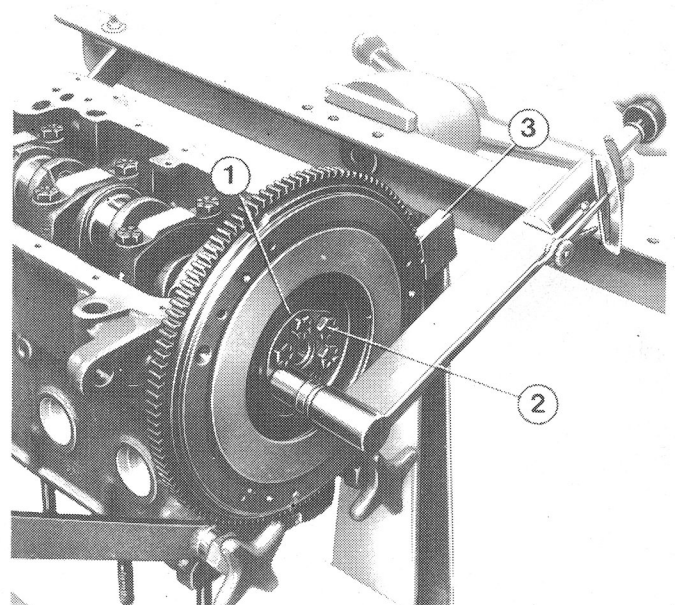
- | | | |
|-----------------------------|------------------------|---------------------------------|
| 1. Gasket | 7. Bolt and lockwasher | 13. Auxiliary shaft lockplate |
| 2. Bolt and lockwasher | 8. Bolt and lockwasher | 14. Bolt and lockwasher |
| 3. Water jacket cover plate | 9. Oil drain plug | 15. Oil seal |
| 4. Gasket | 10. Oil sump | 16. Gasket |
| 5. Flywheel end cover plate | 11. Gasket | 17. Timing gear end cover plate |
| 6. Oil seal | 12. Gasket | 18. Oil seal |
| | | 19. Bolt and lockwasher |

Secure the flywheel to the crankshaft with washer plate (1) and six bolts (2).

Block the crankshaft with tool A. 60369 (3).

Torque flywheel bolts (2) to 61 ft. lbs. (8.5 kgm).

1. Washer plate 2. Bolt 3. Tool A. 60369.



Thoroughly lubricate pistons (1) and cylinder bores with clean engine oil. Install the piston-rod assemblies in the cylinder bores using appropriate piston ring compressor (2).

NOTE: Before and during installation of piston-rod assemblies, refer to **PISTONS AND CONNECTING RODS** for procedures and inspections.

Install the assemblies in the proper cylinder, according to number stamped on the connecting rods and caps. When installation is complete these numbers should face away from the auxiliary shaft.

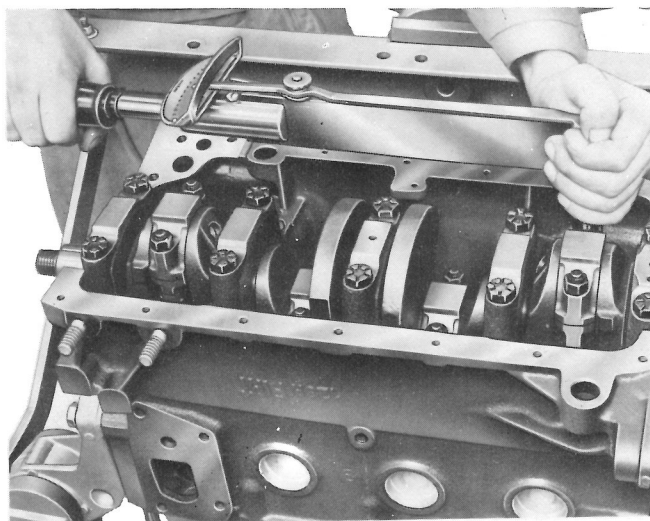
1. Piston 2. Piston ring compressor



Thoroughly lubricate the connecting rod bearing inserts and journals with clean engine oil.

Position the connecting rod with the bearing inserts on the journals.

Install the caps with the bearing inserts and torque the nuts to 38 ft. lbs. (5.2 kgm).

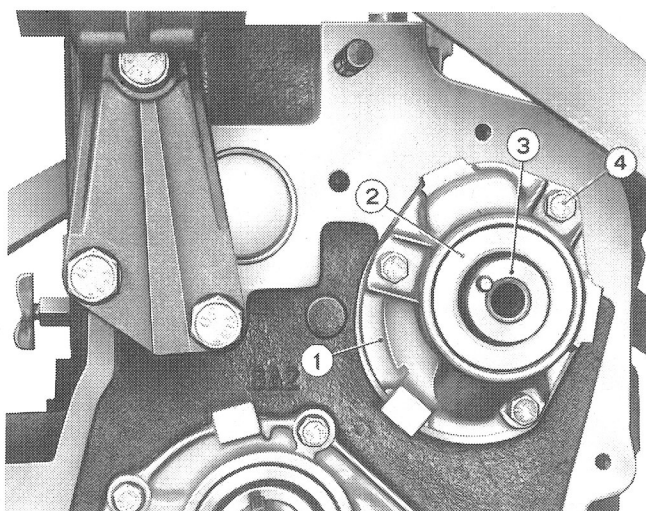


Thoroughly lubricate the bushings for auxiliary shaft (3) with clean engine oil.

Install shaft (2). Place gasket on lockplate (1) and secure the shaft in place with three bolts (4), lockwashers, lockplate (1), and new seal (2).

Install the auxiliary shaft sprocket with bolt and washer. Do not fully tighten the bolt at this time.

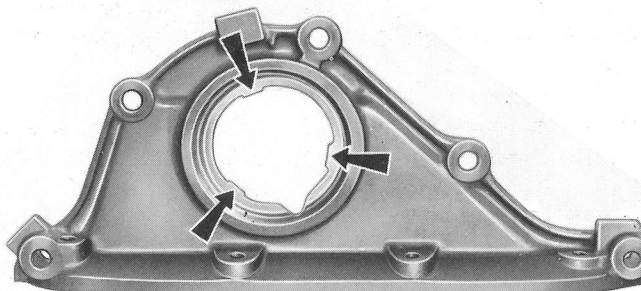
1. Lockplate 2. Seal 3. Auxiliary shaft
4. Bolt.



Install a new seal and gasket on the timing gear end cover plate.

Install the cover plate on the crankcase and secure it with five bolts and lockwashers.

NOTE: Arrows in the illustration point to references for centering the cover plate on the crankshaft.



Install oil pump (1) and gasket. Before the final tightening of bolts (5), install the oil pump and distributor drive gear, coupling it to the gear on the auxiliary shaft.

Rotate the auxiliary shaft using sprocket (2) while tightening oil pump bolts (5) alternately.

Install oil return pipe (4) with one bolt (6) and lockwasher.

Install crankshaft sprocket (7) and crankshaft pulley (8), install pulley nut (9), and with flywheel blocked, torque nut to 101 ft. lbs. (14 kgm).

1. Oil pump
2. Auxiliary shaft sprocket
3. Ignition distributor
4. Oil return pipe
5. Bolt
6. Bolt
7. Timing belt drive sprocket
8. Crankshaft pulley
9. Pulley nut

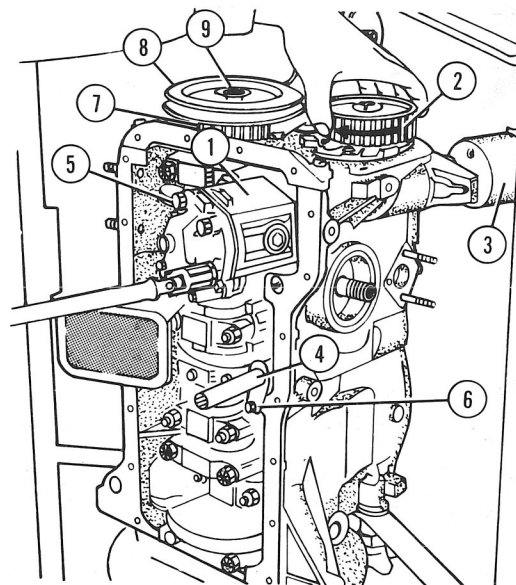
Install the oil pan and gasket with twenty bolts and lockwashers.

Install the cylinder head assembly and new gasket complete with valves, springs, camshaft housing, manifolds, and carburetor.

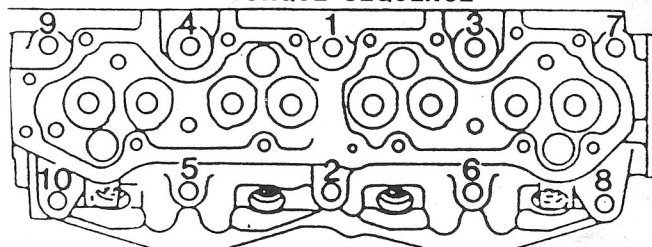
Install ten bolts (1) and flat washers. Gradually tighten bolts in the sequence shown and in the following two stages:

1st step, tighten to approximately 15 ft. lbs. (2 kgm).

2nd step, tighten to 30 ft. lbs. (4 kgm).



TORQUE SEQUENCE

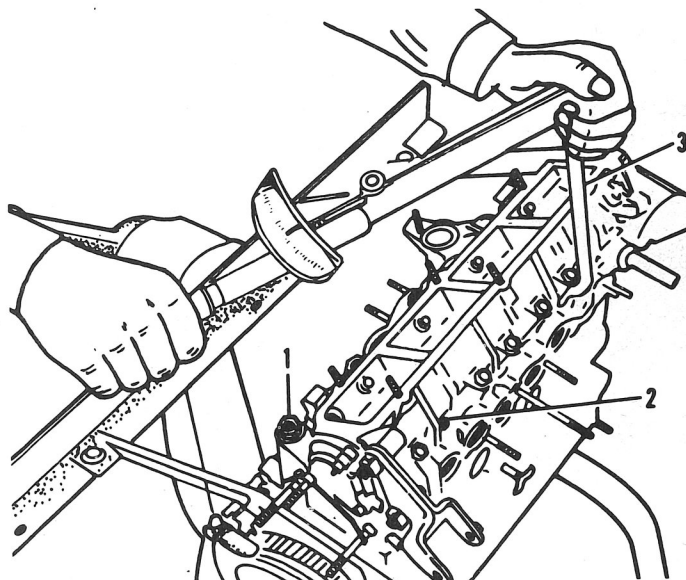


FRONT OF VEHICLE

NOTE: Before and during cylinder head installation refer to CRANKCASE AND CYLINDER HEAD section for procedures and inspections.

1986 and 1987 models are different in their final torquing values and procedures.

1. Bolt
2. Nut
3. Wrench A 50131



Install belt shields (15 & 16).

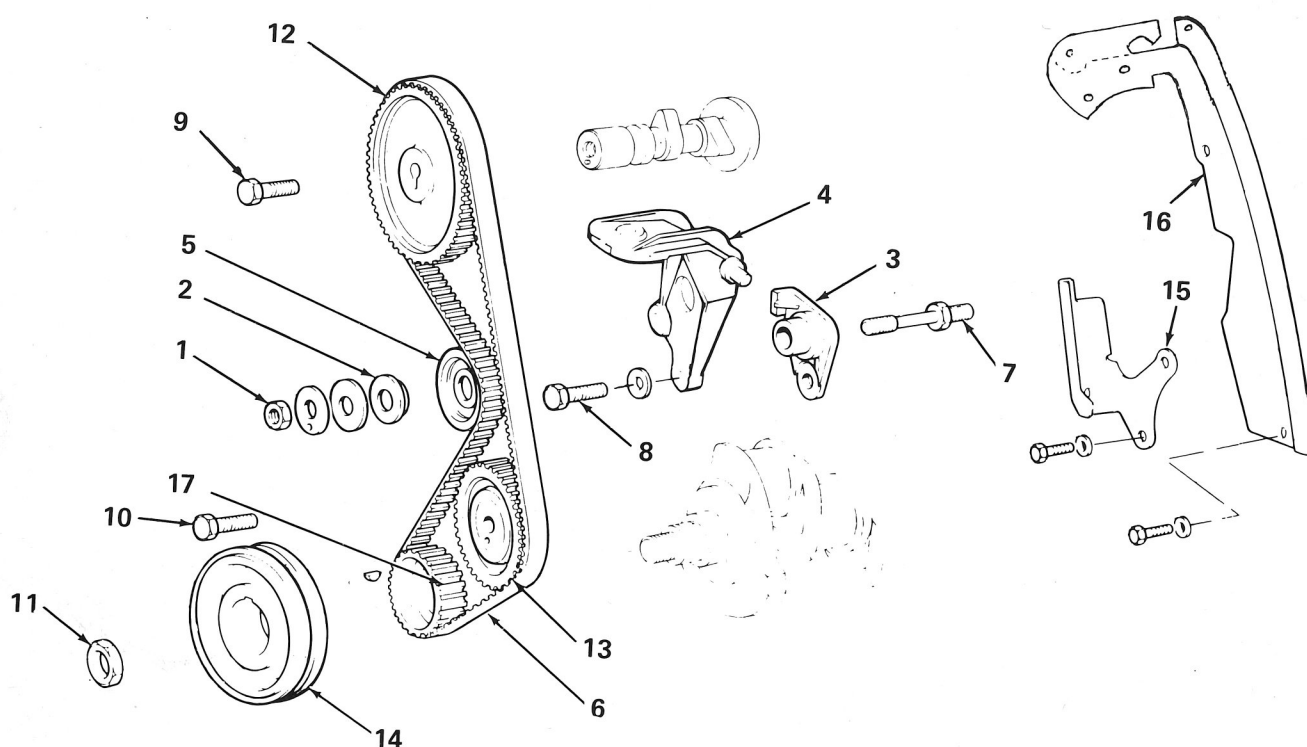
Install camshaft sprocket (12) with bolt (9) and washer. Do not fully tighten bolt at this time.

Install engine mount (4) with three bolts (8) and lockwashers.

Install the spring tensioner in its seat in the mount.

Install tensioner pulley support stud (7) and bracket (3) on crankcase.

Install tensioner pulley (5) on bracket (3) and temporarily secure it with nut (1), washers and spacer (2). Do not fully tighten at this time.



- | | | | |
|------------------------------|---------------------|-----------------------|------------------------------|
| 1. Nut | 5. Tensioner pulley | 9. Bolt | 13. Auxiliary shaft sprocket |
| 2. Spacer | 6. Timing belt | 10. Bolt | 14. Crankshaft pulley |
| 3. Tensioner support bracket | 7. Stud | 11. Nut | 15. Belt shield |
| 4. Engine mount | 8. Bolt | 12. Camshaft sprocket | 16. Belt shield |
| | | | 17. Crankshaft |

Turn engine with wrench A. 50121 until mark on crankshaft sprocket is aligned with reference index. Position the camshaft sprocket so that marks are aligned.

NOTE: Auxiliary shaft sprocket does not have to be aligned.

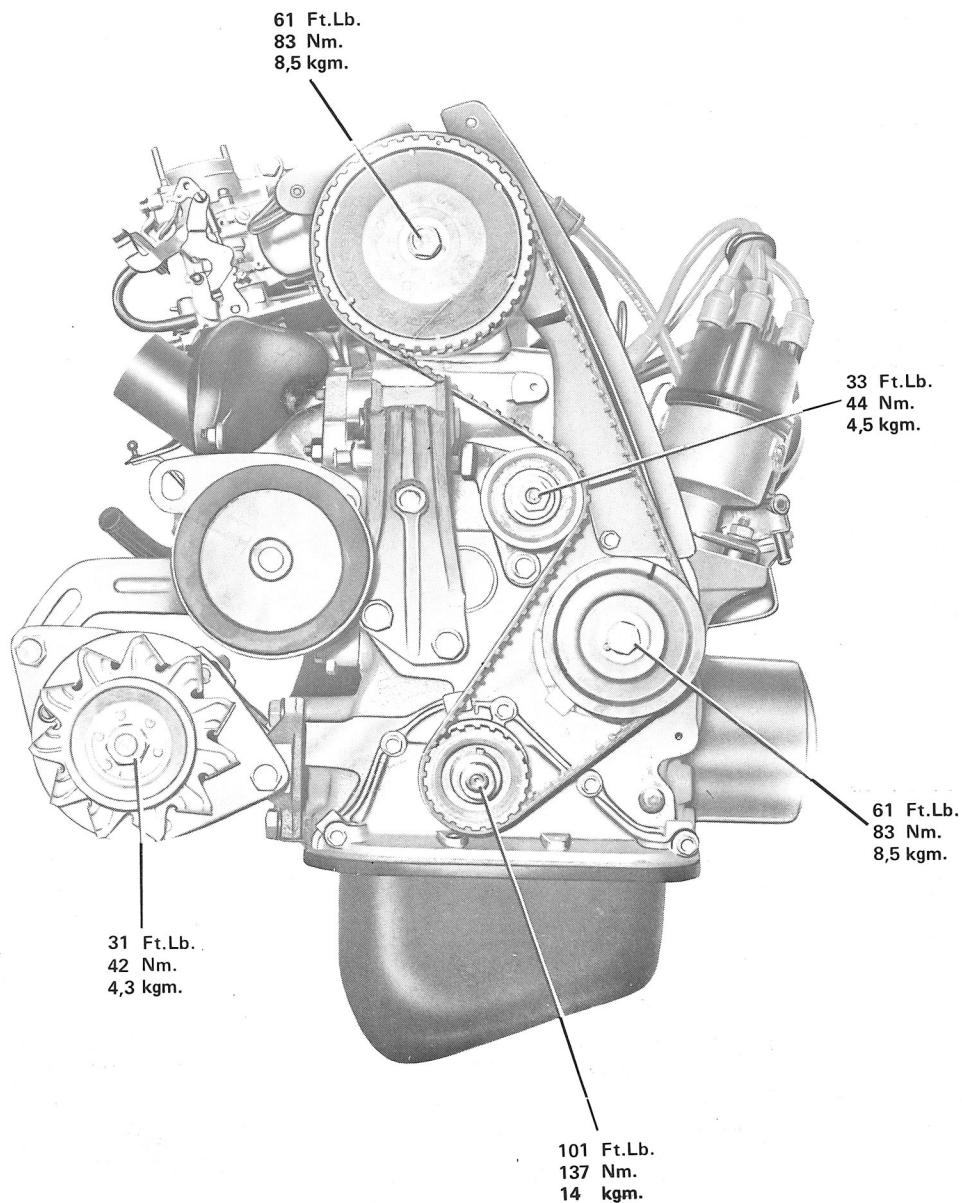
Move the tensioner pulley toward the engine mount and tighten the nut to hold it there. Install the timing belt with slack on tensioner side.

CAUTION: Always install a new timing belt. Timing belts cannot be reused. Under no circumstances must belt tension be adjusted following its initial installation.

Make sure the timing belt teeth are perfectly coupled with the sprockets.

Loosen the nut holding the tensioner pulley and the tensioner will tighten the belt. Torque the tensioner pulley nut in this position to 33 ft. (4.5 kgm). Check that the timing marks are still correctly aligned.

With the flywheel blocked, torque the auxiliary shaft sprocket bolt and the camshaft sprocket bolt to 61 ft. lbs. (8.5 kgm).

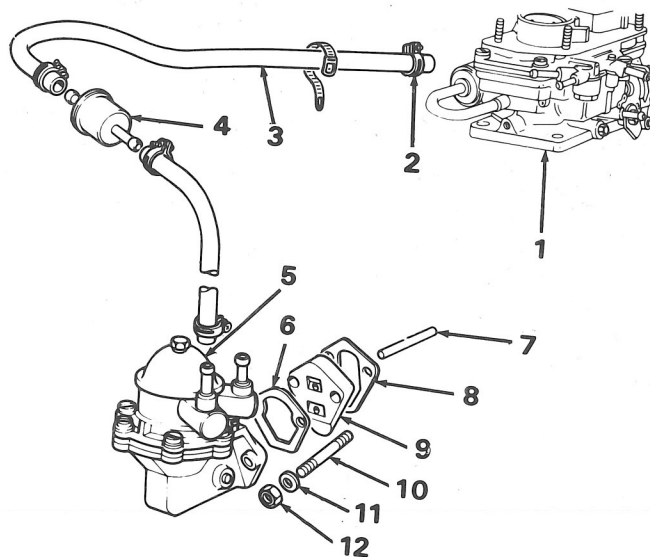


Install fuel pump (5) with gaskets (6 & 8), insulator (9), actuating rod (7) and two nuts (12) and washers (11) in order shown.

NOTE: Gasket (8) comes in three different sizes which are used to adjust pump stroke (pressure).

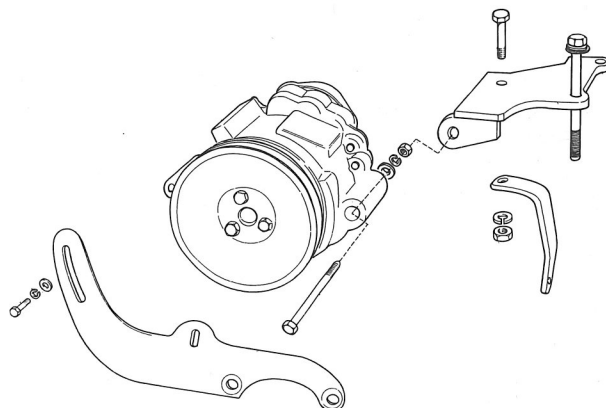
Connect fuel lines (3) and filter (4) to carburetor (1).

1. Carburetor 2. Clamp 3. Fuel hose 4. Fuel filter
5. Fuel pump 6. Gasket 7. Actuating rod 8. Gasket
9. Insulator 10. Stud 11. Washer 12. Nut.



Screw the check valve into the exhaust manifold and secure it with the locknut.

Install the air pump with the bolts and washers. Connect the air hoses to the air pump and check valve.

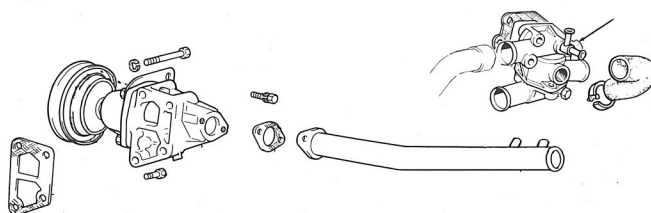


Install the thermostat housing and gasket on the crankcase with the bolts and washers. Install the water pump and gasket on the crankcase with the bolts and washers. Torque the bolts to 18.5 ft. lbs. (2.5 kgm).

Install the coolant pipe and gasket to the water pump with the bolts.

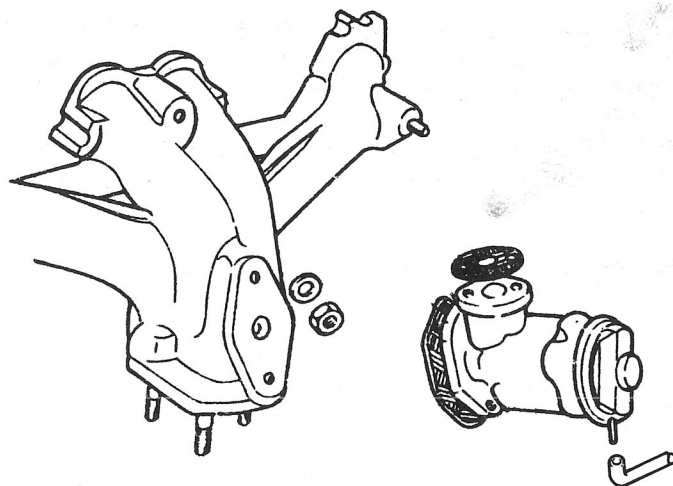
Connect the coolant hoses to the thermostat housing.

Install new air pump belt on air pump and water pump pulleys. Tighten air pump mounting bolts and belt. Check for about 1/2 inch deflection with moderate finger pressure.



Install the EGR valve base, gasket, EGR valve, and gasket with bolts and washers.

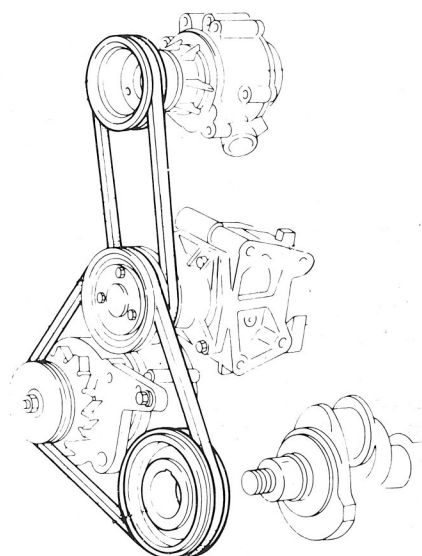
Connect the vacuum hose and EGR tube to the EGR valve. Connect EGR tube to the carburetor base and exhaust manifold with spacer and gasket.



Install the alternator mounting bracket with the bolts and washers.

Install the alternator to the bracket with the bolts, washers, and nuts.

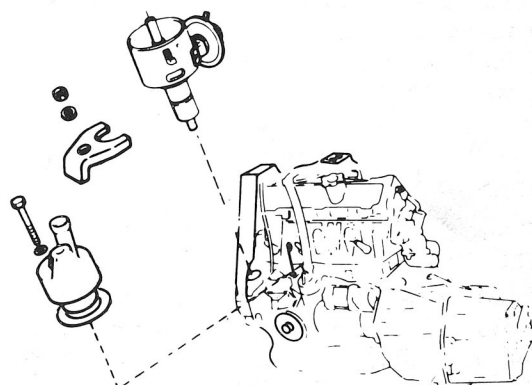
Install new drive belt on crankshaft, water pump, and alternator pulleys. Fully tighten the alternator mounting bolts to tension belt. Check for about 1/2 inch deflection with moderate finger pressure. Install the timing belt cover.



Turn the crankshaft until timing marks are aligned. Remove the distributor cap and rotate the shaft until the rotor faces terminal corresponding to cylinder No. 4.

Without moving the rotor from its position, insert the distributor in the crankcase. Secure the distributor with the bolt and clamp. Final adjustment of timing will be accomplished with a timing light.

Install the crankcase breather and gasket on the crankcase with the bolt. Torque the bolt to 18.5 ft. lbs. (2.5 kgm).



Make sure the clutch and flywheel surfaces are clean. If using the original clutch, align the marks on the flywheel with the marks on the clutch.

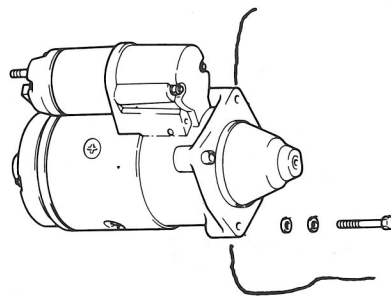
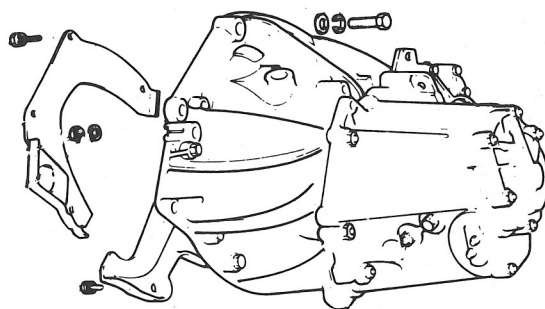
With the protruding part of the disc hub facing away from the flywheel, loosely fasten the clutch assembly to the flywheel.

Using pilot tool A. 70210, center disc with pressure plate. Gradually torque mounting bolts to 12 ft. lbs. (1,6 kgm). Remove pilot tool.

Lightly coat the transmission shaft with white grease. Install the transmission and covers on the engine with the bolts.

Install the starter on the engine with the three bolts and washers.

Install the oil dipstick and the oil filter.



CRANKSHAFT — MAIN BEARINGS**MAIN BEARING JOURNALS AND ROD JOURNALS INSPECTION**

Carefully inspect the crankshaft for cracks on the main bearing journals and rod journals as well as on crank arms. If any are detected, the crankshaft should be replaced to insure against breakage during operation.

If the journals show light traces of scuffing, these can be dressed off by using extra-fine carborundum stone.

If the journals show deep scoring or if micrometer measurements of journals show an out-of-round condition in excess of 0.0002 in. (.005 mm), journals will have to be reground to the next undersize.

When regrounding journals, be sure to pay special attention to the specified fit clearances in relationship to the undersize bearing range available for service.

Depending on the amount of wear, main bearing journals and rod journals should be reground to the undersize diameters shown in the tables.

The same journal shoulder radius that existed originally should be faithfully reproduced.

Refer to illustration.

After the journals have been ground to size and polished, the crankshaft must be thoroughly washed to remove all metal and abrasive particles.

MAIN BEARING JOURNAL DIAMETERS

Standard	Undersize			
	.010 in (0.254 mm)	.020 in (0.508 mm)	.030 in (0.762 mm)	.040 in (1.016 mm)
1.9994 in (50.785 mm) to 2.0002 in (50.805 mm)	1.9894 mm (50.531 mm) to 1.9902 in (50.551 mm)	1.9794 in (50.277 mm) to 1.9798 in (50.287 mm)	1.9694 in (50.023 mm) to 1.9702 in (50.043 mm)	1.9594 in (49.769 mm) to 1.9602 in (49.789 mm)

ROD BEARING JOURNAL DIAMETERS

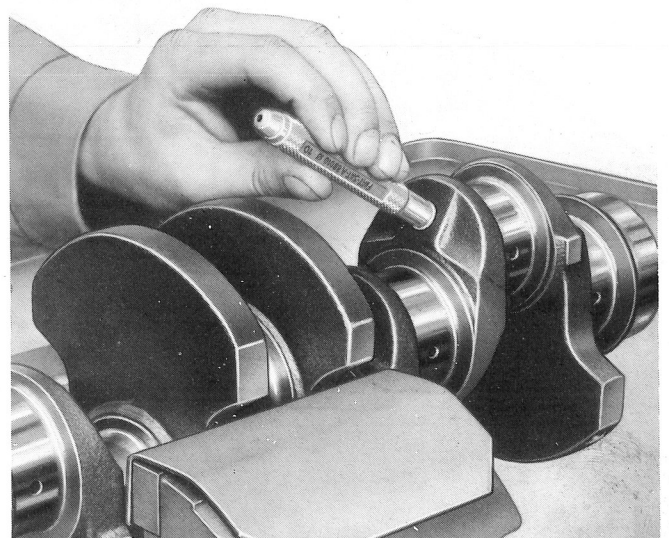
Standard	Undersize			
	.010 in (0.254 mm)	.020 in (0.508 mm)	.030 in (0.762 mm)	.040 in (1.016 mm)
1.7913 in (45.498 mm) 1.7920 in (45.518 mm)	1.7813 in (45.244 mm) 1.7820 in (45.264 mm)	1.7713 in (44.990 mm) 1.7720 in (45.010 mm)	1.7613 in (44.736 mm) 1.7620 in (44.756 mm)	1.7513 in (44.482 mm) 1.7520 in (44.502 mm)

CLEANING OILWAYS

To clean the oilways properly, the welch plugs must be removed. Then ream the plug bores, using reamer A. 94016/10 and pilot A. 94016.

Carefully flush the oilways and blow dry them with compressed air.

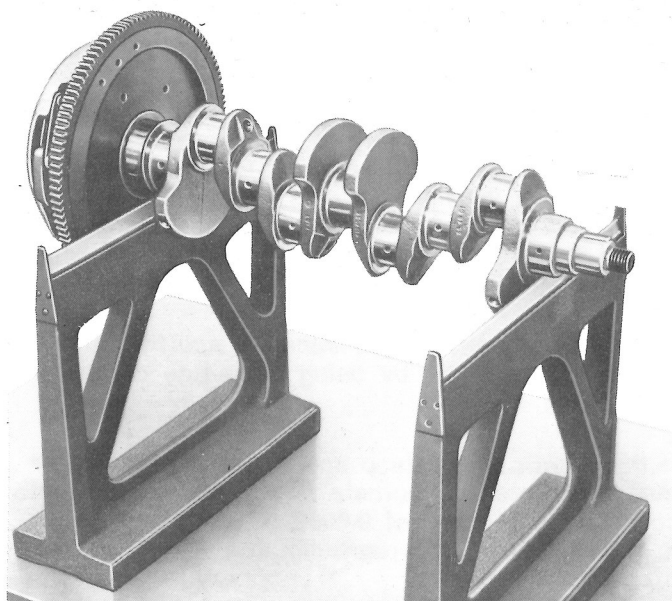
After completing the above operations, drive new welch plugs into place with driver A. 86010 and stake them for safety using a punch.



CHECKING CRANKSHAFT BALANCE

Place two parallel blocks on surface plate. Set crankshaft-flywheel-clutch assembly on the parallel blocks.

If the assembly shows a tendency to roll towards one side, stick some putty on the opposite side until the assembly stops moving. Weighing the amount of putty used will provide an indication of the unbalancing weight. To correct the situation, drill holes on flywheel at point D (See figure below) as required to remove the corresponding weight of metal.



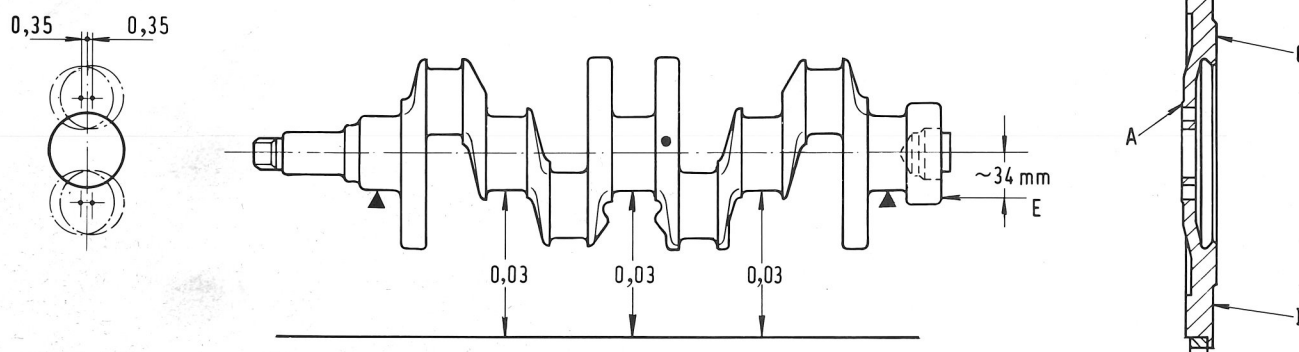
FLYWHEEL AND RING GEAR

Inspect condition of ring gear teeth. If there is any obvious damage, replace the ring gear.

A hydraulic press should be used to install a new ring gear onto flywheel, after heating the gear to 176°F (80°C) in an oil bath.

Make sure the flywheel contact surfaces with the crankshaft and the clutch driven disc are absolutely smooth and free from scratches or scores. Surfaces should also be perfectly flat and at right angles to the flywheel rotation axis.

With flywheel centered on the crankshaft, rotate the flywheel and measure points B and C with a dial gauge. Points B and C should not show variations in excess of .004 in. (0.1mm).



$$.001 \text{ in} = 0.03 \text{ mm} \quad .014 \text{ in} = 0.35 \text{ mm} \quad 1.3 \text{ in} = 34 \text{ mm}$$

Maximum allowable misalignment of journals and rod journals, and diagram for checking flywheel contact surfaces with clutch disc and crankshaft flange.

(A — B — C — E = points for checking alignment and squareness with respect to rotation axis; D = crankshaft-flywheel-clutch assembly balancing holes).

Checking Main Bearing Journals and Rod Journals for Misalignment

Rest crankshaft ends on two parallel blocks and check the following with a dial gauge:

- main journal misalignment: maximum allowable tolerance .001 in (0.03mm) (total dial gauge reading)
- rod journal misalignment: maximum allowable tolerance, with respect to journals $\pm .014$ in. (± 0.35 mm)
- main bearing journals and rod journals out-of-round maximum allowable tolerance, after re-grinding, .0002 in. (0.005mm)
- squareness of flywheel resting face to crankshaft centerline: when rotating the crankshaft, a dial gauge resting laterally some 1.34 in. (34mm) (position E in illustration) from the crankshaft centerline, should not show variations in excess of .001 in (0.025mm)

If inspection of main bearing journal and rod journal alignment reveals distortions, the shaft should be straightened using a hydraulic press. Be careful not to subject the shaft to excessive stress which could damage its internal structure.

MAIN BEARINGS

If inspection shows bearings to be scored or have signs of seizure or abnormal wear, they should be replaced. No reconditioning or adaptation of damaged bearings is possible.

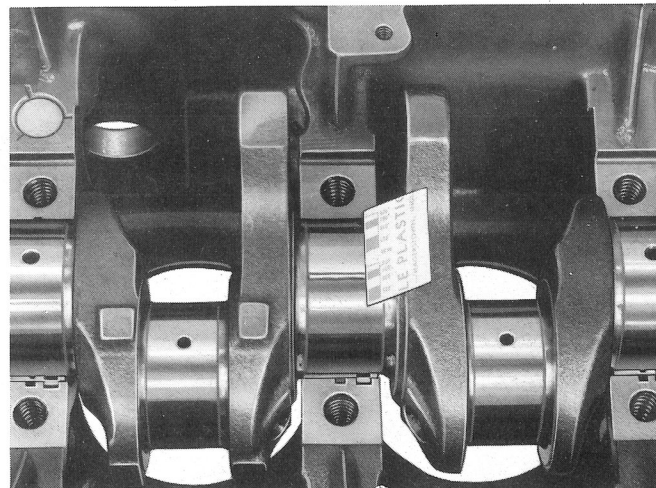
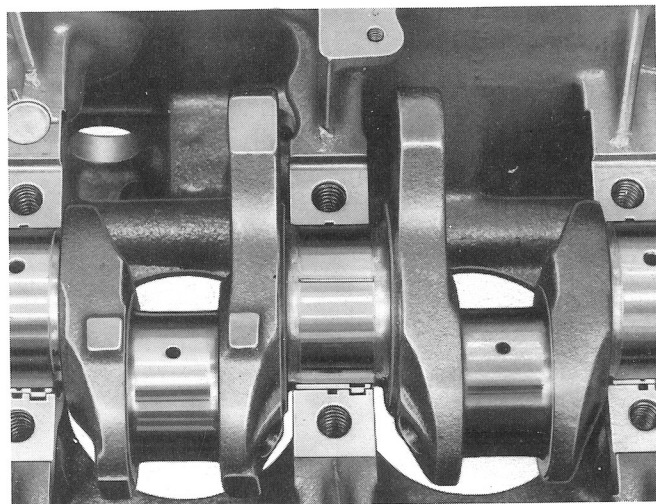
If inspection proves their condition to be satisfactory and therefore fit for further service, check clearances between bearings and journals as follows:

- Place a length of calibrated wire, for example Plastigage, along the journal being checked
- Install the caps, complete with bearing shells
- Tighten the cap mounting bolts to a torque of 59 ft. lbs. (8.2 kgm)
- Remove the caps and, using the scale on the Plastigage envelope, measure the width of the flattened wire

The numbers on the envelope show the value of the existing clearance.

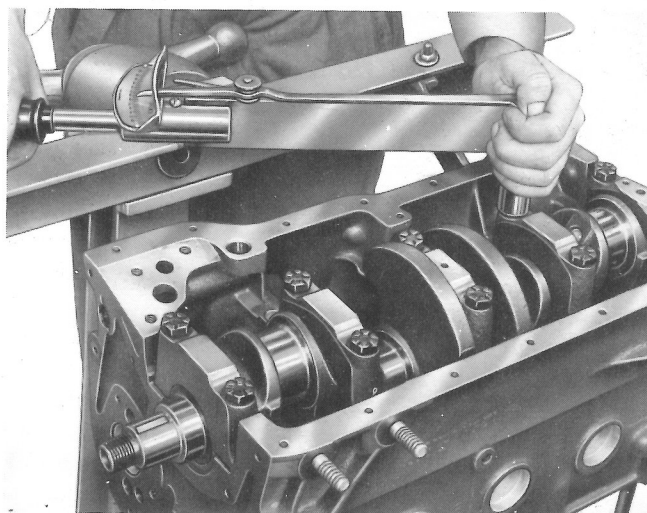
Normal clearance between main bearings and crankshaft journals is .002 to .003 in. (0.040 to 0.085 mm).

If clearance does not fall within the maximum allowable limit of .006 in. (0.15 mm), the bearings must be replaced with undersize ones (see table), after regrinding the crankshaft journals.



When the checking and replacement procedures are completed, install caps and tighten the bolts to the specified torque of 59 ft. lbs. (8.2 kgm).

Free crankshaft rotation is an indication that the assembly has been performed correctly and bearing clearances conform to specifications.

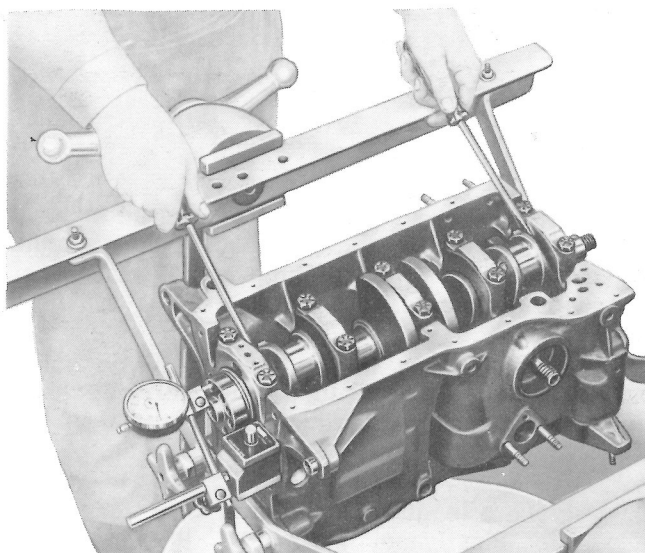


CHECKING CRANKSHAFT END PLAY

Once the crankshaft has been installed, check end play between thrust rings on rear main bearing saddle and crankshaft shoulders.

Install magnetic base dial gauge and wedge two screwdrivers as shown.

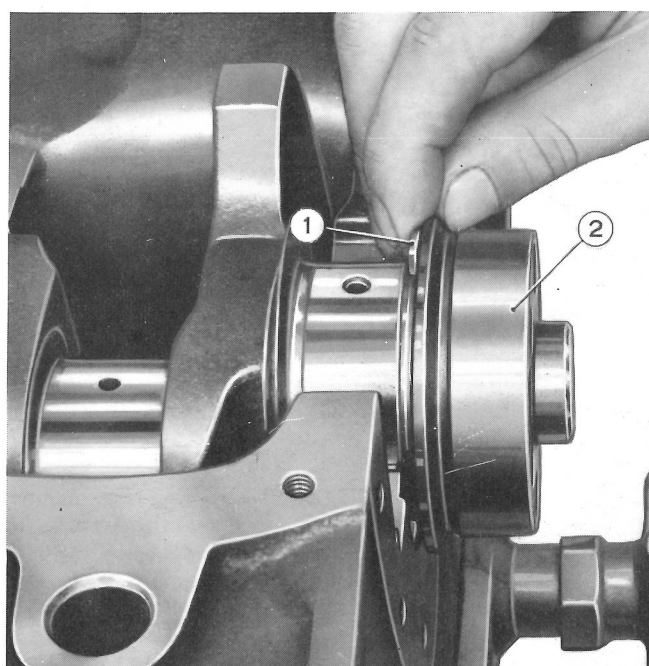
Using the screwdrivers, pry the crankshaft back and forth and check on dial gauge to see if the end movement falls within .002 to .010 in (0.055 to 0.265 mm).



If end play is more than the maximum allowable limit of .0137 in. (0.35 mm), replace the thrust rings with .005 in (0.127 mm) oversize rings, which are available for service.

When installing service thrust rings, make sure that the grooves on the thrust ring are facing the crankshaft shoulder.

1. Thrust ring 2. Crankshaft



CHECKING OIL SEALS

Metal-cased, spring-loaded rubber seals are fitted at both crankshaft ends to insure proper seal. Whenever crankshaft is being serviced, it is advisable to replace both oil seals.

CYLINDER BLOCK AND CRANKCASE

CLEANING

Immerse the crankcase in a washing tank containing a water and soda solution warmed to a temperature of 176° to 185°F (80° to 85°C) for about 20 minutes.

Then spray the crankcase with the same solution to clean off any dirt deposits from the oilways. Blow the crankcase dry with compressed air, particularly all the oil passages.

When the crankcase is being overhauled, thoroughly clean the oil and coolant passages as follows:

- remove the plugs with a punch
- install coolant plugs with a flat plate
- install the blow-by gas and oil vapor plugs with the installer A. 86202.

INSPECTION AND MEASURING CYLINDER BORES

Carefully examine cylinder bore surfaces. If only slight scoring or scratches are found, dress bore.

Use extra fine emery cloth wrapped around a hone.

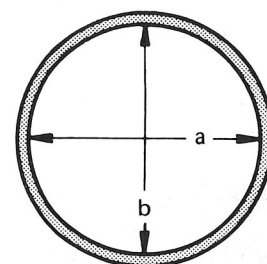
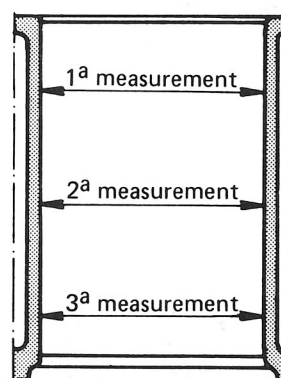
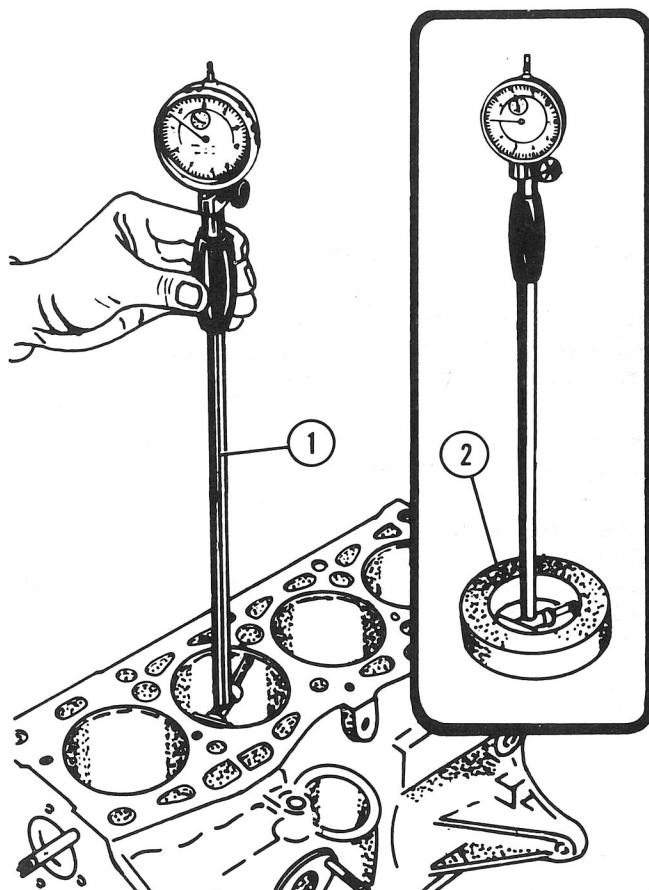
Zero the dial indicator with ring gauge A. 95646.

Check cylinder bore with gauge A. 95687 at three points, both lengthwise and crosswise.

If wear or out-of-round is such as to require reconditioning, the following should be done:

- If metal to be removed is less than .006 in. (0.15 mm), honing will do.
- If it exceeds .006 in. (0.15 mm), the cylinder block should be rebored.

Cylinders should not be rebored beyond .031 in. (0.8 mm)

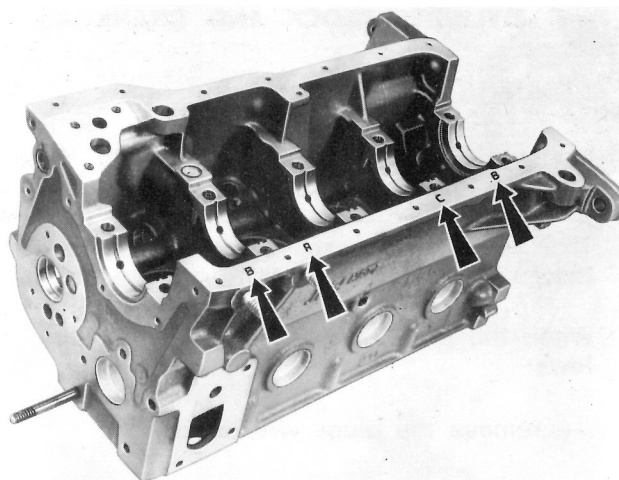


1. Dial gauge A. 95687
2. Ring gauge A. 95646
for zero setting dial gauge.

Bores should be reconditioned in relation to the diameter of oversize pistons available (.0079, .0157, .0236, .031 in (0.2, 0.4, 0.6, 0.8 mm) and to specified clearance of .001 to .002 in (0.024 to 0.047 mm) between pistons and bores.

As shown, letters are stamped on bottom face of cylinder block, opposite each bore, to indicate their diameter. This is done since the actual bore may vary from 3.1496 to 3.1516 in. (80.000 to 80.050 mm) and bores are selected in .0004 in (0.01 mm) classes.

Standard pistons are also selected in classes and must be matched with cylinder bores belonging in the same class (Refer to PISTONS AND CONNECTING RODS



Cylinder bore class selection.

The arrows show identification letters of cylinder bore classes.

CYLINDER BLOCK GASKET SURFACE

The cylinder block gasket surface may become warped or distorted.

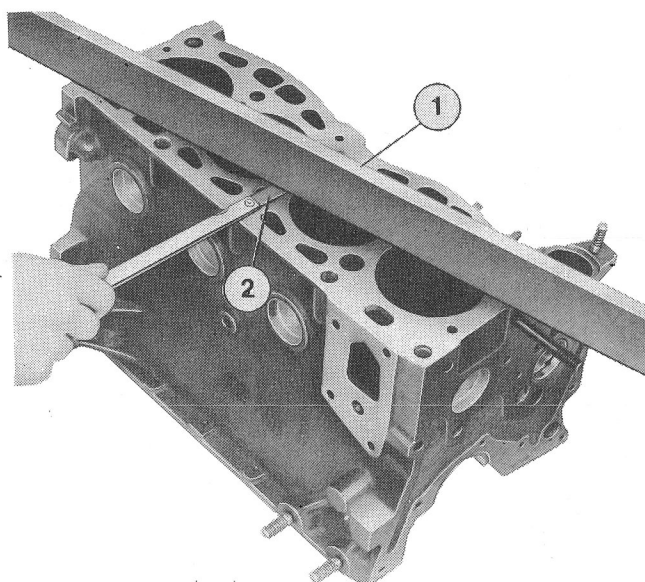
The check may be done with a straightedge (1) and feeler gauge (2).

The straightedge should be placed in line with the diagonals of the cylinder block surface and lengthwise in the middle.

Maximum allowable warpage is .004 in (0.10 mm).

When resurfacing cylinder block, be careful to remove as little metal as possible.

1. Straightedge
2. Feeler gauge



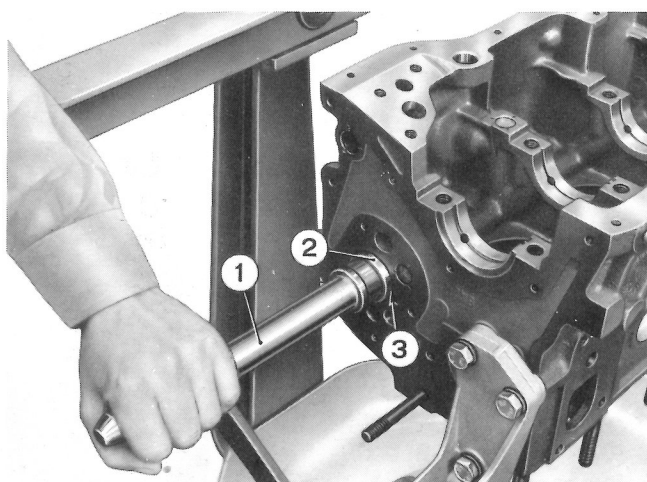
AUXILIARY SHAFT BORES AND BUSHINGS

Check that the bushings press-fitted in the crank-case bores for the auxiliary shaft are not out-of-round or loose. Check that the oil holes in the bushings are in exact alignment with the crank-case oil passages.

The inner surface of the bushings should be smooth and free from scuffing. Replace them if they are damaged.

Should it become necessary to replace the bushings, remove the old ones from the bores using driver A. 60372/1/2 for drive end bushing and A. 60372/1 for inside bushing.

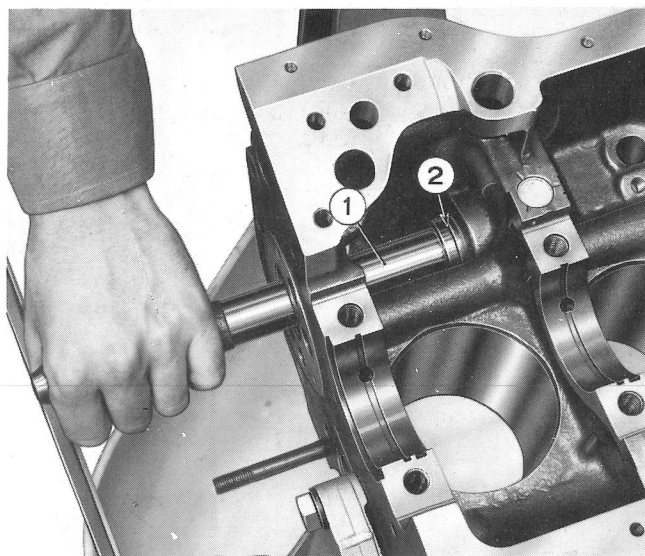
1. Driver A. 60372/1
2. Tool A. 60372/2
3. Bushing, drive end



The bushings are press fitted to their own bores in the crankcase. First install inside bushing (2) using driver A. 60372/1 (1) and then drive end bushing using driver A. 60372/1/2.

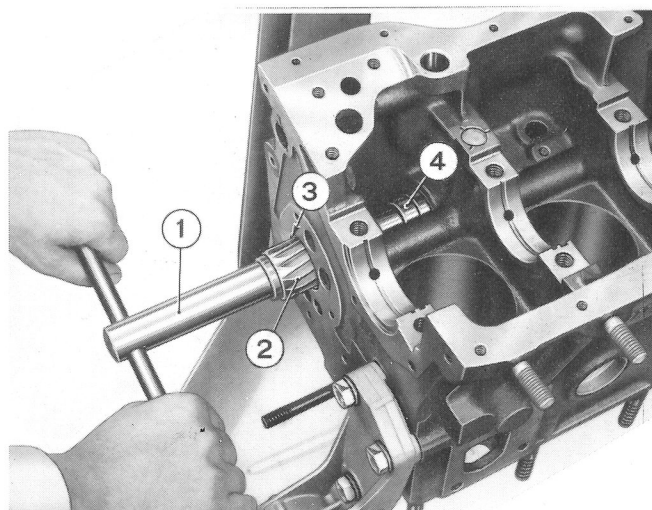
When installing the bushings, make sure to position them so that the bushing oil hole is perfectly aligned with oil passage in the crankcase.

1. Driver A. 60372/1 2. Bushing

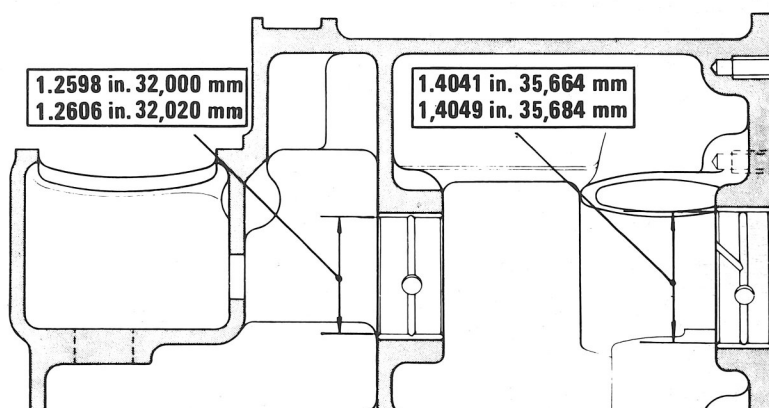


After the bushings have been press fitted in place, finish ream them with tool A. 90365 (1) to specified inside diameter (see figure below). This assures a correct fit and alignment of the auxiliary shaft journals.

1. Reamer A. 90365 2. Cutter 3. Bushing
4. Centering pin



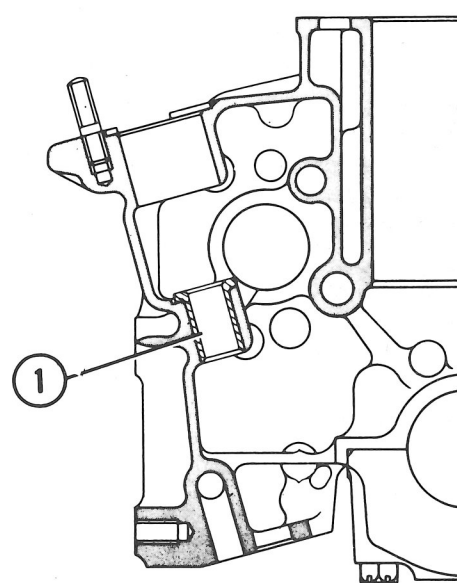
Specifications of the Auxiliary Shaft Bushings



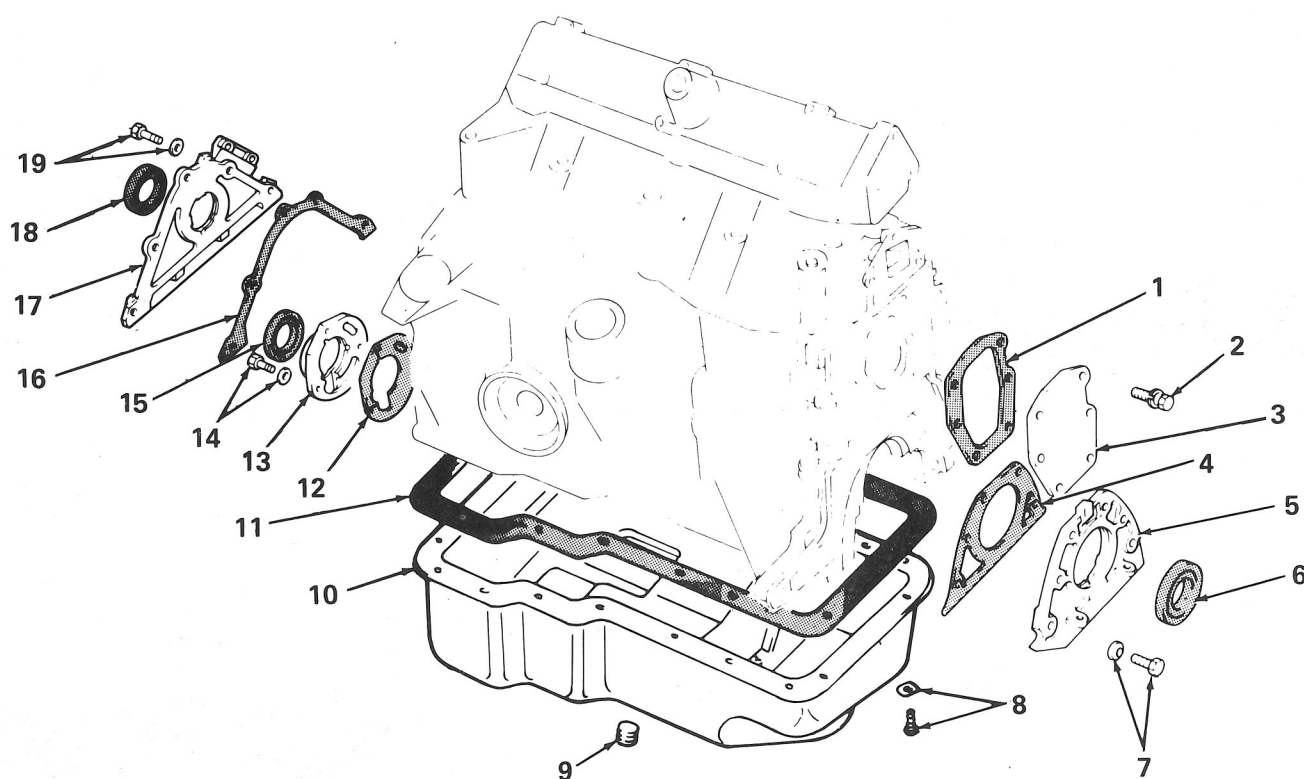
DISTRIBUTOR AND OIL PUMP DRIVE GEAR BUSHING

Check that bushing (1) has not ovalized or become loose in its bore. The inner surface should be smooth and show no traces of wear. Replace if necessary.

1. Bushing



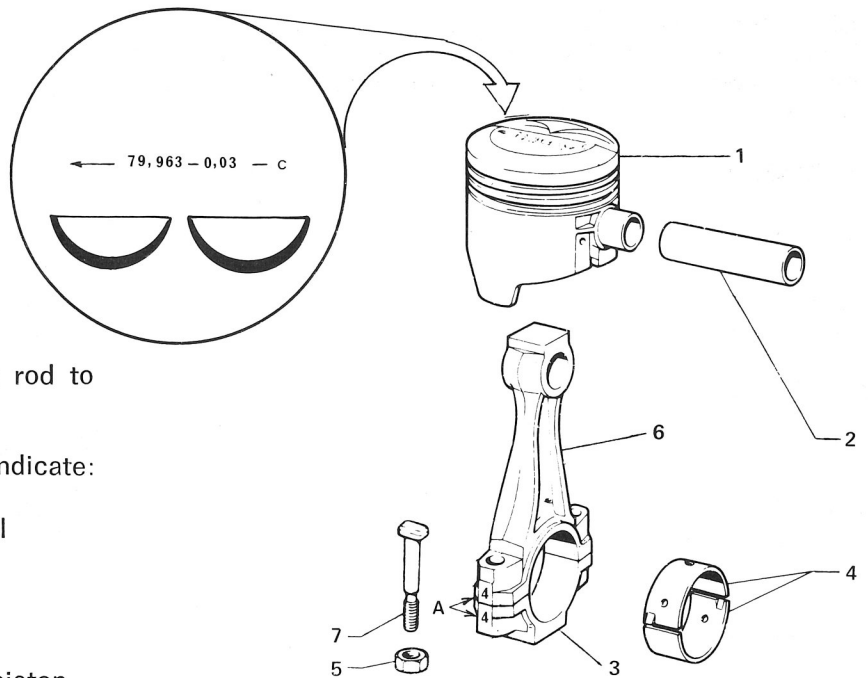
Gaskets and seals



- | | | |
|-----------------------------|-----------------------------|---------------------------------|
| 1. Gasket | 4. Gasket | 12. Gasket |
| 2. Bolt and lockwasher | 5. Flywheel end cover plate | 13. Auxiliary shaft lockplate |
| 3. Water jacket cover plate | 6. Oil seal | 14. Bolt and lockwasher |
| | 7. Bolt and lockwasher | 15. Oil seal |
| | 8. Bolt and lockwasher | 16. Gasket |
| | 9. Oil drain plug | 17. Timing gear end cover plate |
| | 10. Oil pan | 18. Oil seal |
| | 11. Gasket | 19. Bolt and lockwasher |

PISTON — ROD ASSEMBLY

1. Piston
2. Pin
3. Big-end-cap
4. Bearings
5. Cap nut
6. Connecting rod shank
7. Cap bolt



A = Matching number of connecting rod to cylinder.

Markings stamped on the piston top indicate:

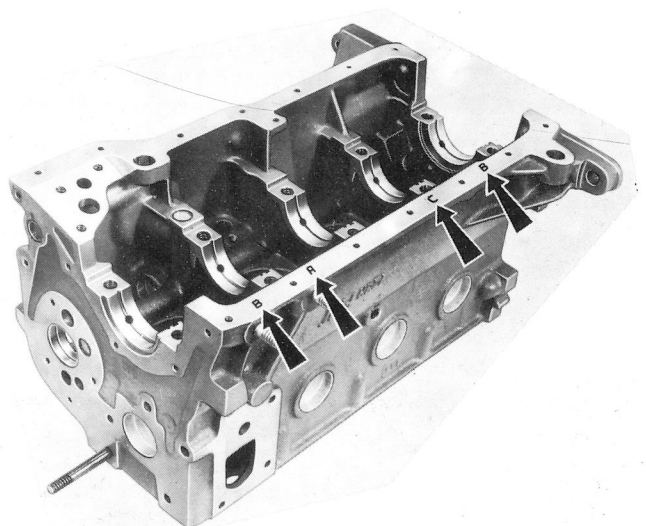
- Arrow points towards the flywheel when fitting.
- 79,693 mm — Piston diameter.
- 0,03 mm — Clearance between piston and bore.
- "C" — Piston class.

When assembling piston, pin, and connecting rod note the following:

- Arrow stamped on the top of the piston should point to the flywheel.
- The bore matching number (A) stamped on the side of the connecting rod must be on the opposite side of the cylinder bore from the auxiliary shaft.

When installing the piston-rod assembly make sure the piston class matches the bore class (markings should be the same). The bore class is stamped on the cylinder block as shown.

The arrows show identification letters of cylinder bore classes.



Checking Piston Clearance in Cylinder Bore and Pin Clearance in Piston

Clearance of the piston in the cylinder bores, measured at right angles to the piston pin and .875 in. (22.2 mm) from the piston skirt edge is .001 to .002 in. (0.024 to 0.047 mm).

Be sure to always add piston skirt wear to cylinder wall wear to determine actual clearance between parts.

Piston clearance in bore must not exceed 0.006 in. (0.15 mm).

Upsize pistons are available in five oversizes:

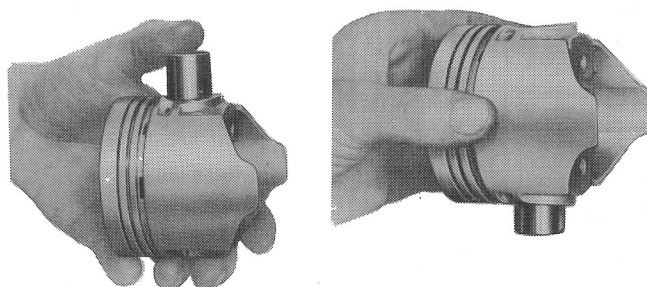
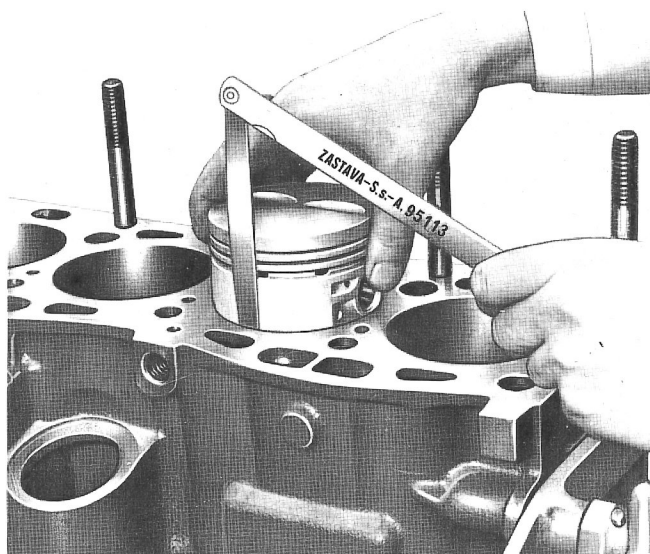
- .004 in. (0.1 mm)
- .008 in. (0.2 mm)
- .016 in. (0.4 mm)
- .024 in. (0.6 mm)
- .031 in. (0.8 mm)

Upsize pins are only available in 0.0079 in. (0.2 mm) oversize.

Pin clearance in the boss bore is .0004 to .0007 in. (0.008 to 0.018 mm).

To check pin fit, lubricate the pin with light engine oil and insert it into the piston bore. If fit is correct:

- pin should slide in by thumb pressure;
- when holding the piston with pin in vertical position, pin should not fall from piston under its own weight.



Checking Piston Weight

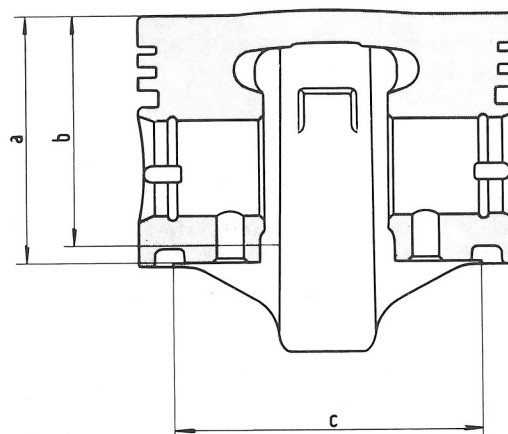
Before assembly, check that the four pistons have the same weight; maximum permissible tolerance is $\pm .088$ oz. (± 2.5 g).

If four pistons with their weights within the tolerance are not available, material may be removed from heavier ones.

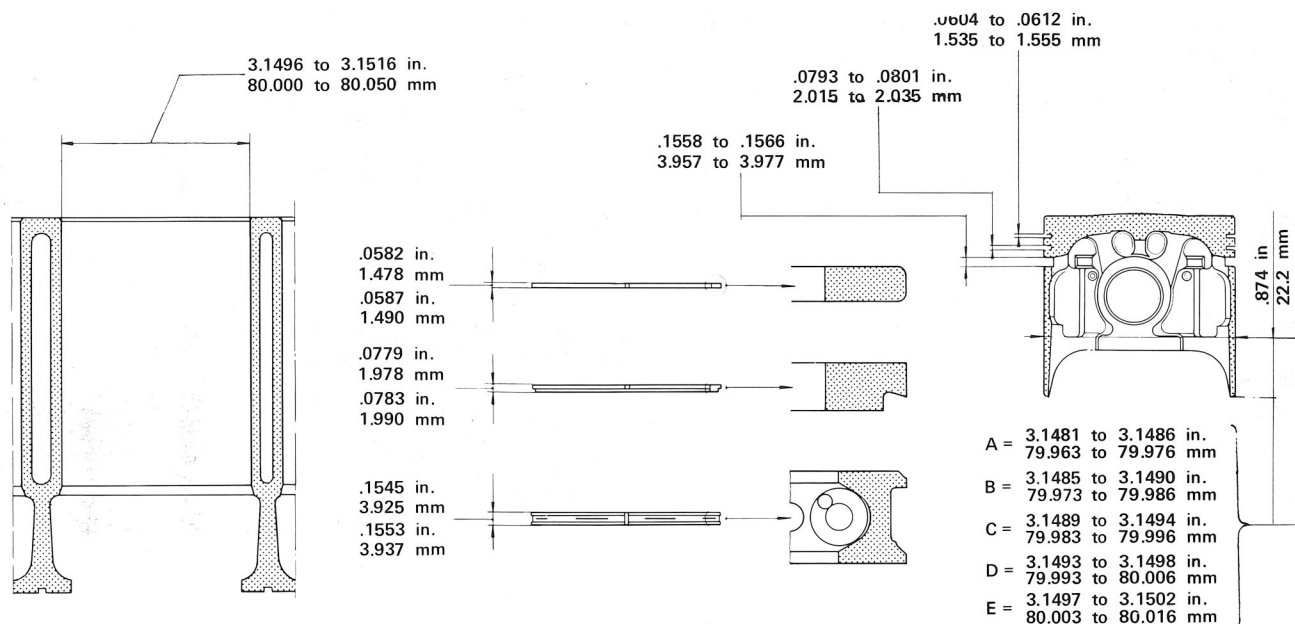
Milling should not be done beyond a depth of .177 in. (4.5 mm) compared to nominal piston height of 2.232 in. (56.70 mm) and milling diameter should be limited to 2.775 in. (70.5 mm).

Milling diagram for balancing piston weight.

- a = 2.232 in (56.70 mm) nominal piston height.
- b = 2.055 in (52.20 mm) minimum height after milling.
- c = 2.775 in (70.50 mm) maximum milling diameter.



SPECIFICATIONS OF CYLINDER BORE, PISTON AND RINGS

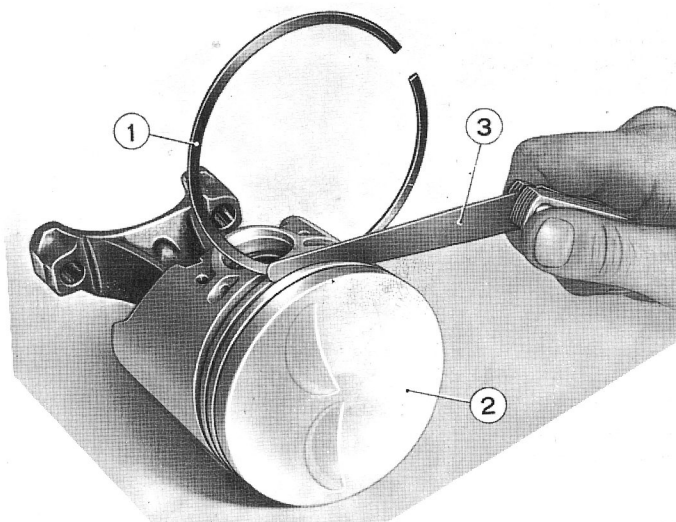
**Piston Ring Side Clearance**

Side clearance of the piston ring in the grooves is checked by installing the ring (1) and using a feeler gauge to measure clearance. Maximum wear limit is .006 in. (0.15 mm).

Piston ring fit (side clearance for new parts):

- first: compression ring002 to .003 in (0.045 to 0.077 mm)
- second: oil ring001 to .002 in (0.025 to 0.057 mm)
- third: scraper ring001 to .002 in (0.020 to 0.052 mm)

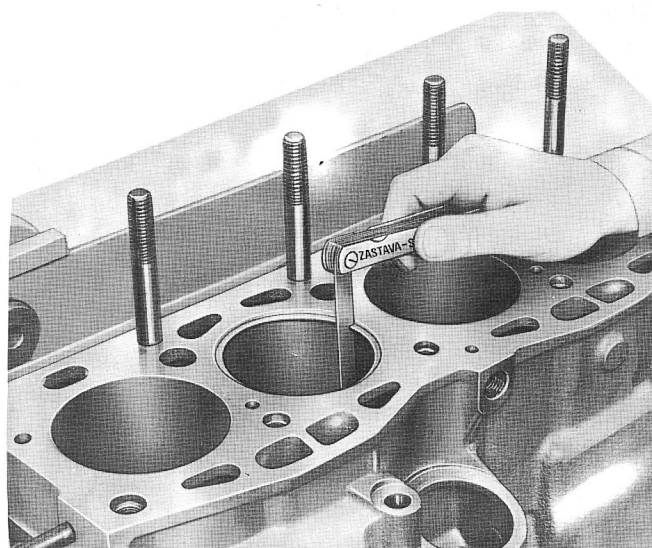
1. Ring 2. Piston 3. Feeler gauge

**Ring End Gap**

Prior to installing the rings on the pistons, push them down squarely into the bores and check that ring end gap is within tolerances below. If the gap is less than specified, grind ring ends as required.

When installing rings on pistons, stagger end gaps 120° apart.

- first: compression ring012 to .018 in (0.30 to 0.45 mm)
- second: oil ring008 to .014 in (0.20 to 0.35 mm)
- third: scraper ring008 to .014 in (0.20 to 0.35 mm)



REMOVING PISTON PIN

The piston pin floats in the boss of the piston but is press fitted into the connecting rod.

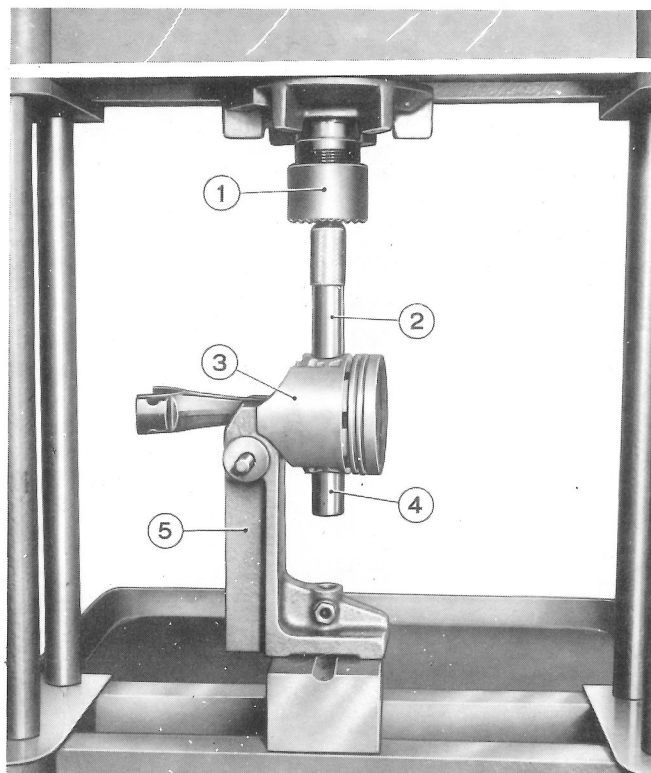
For proper removal and installation, use the appropriate tools.

To remove the pin, put the assembly in a press and use tool A. 95615 and driver A. 60379.

Piston pin fit in rod0006 — .0015 in
interference (0.014 to 0.038 mm)

Piston pin fit in piston0003 — .0007 in
clearance (0.008 to 0.018 mm)

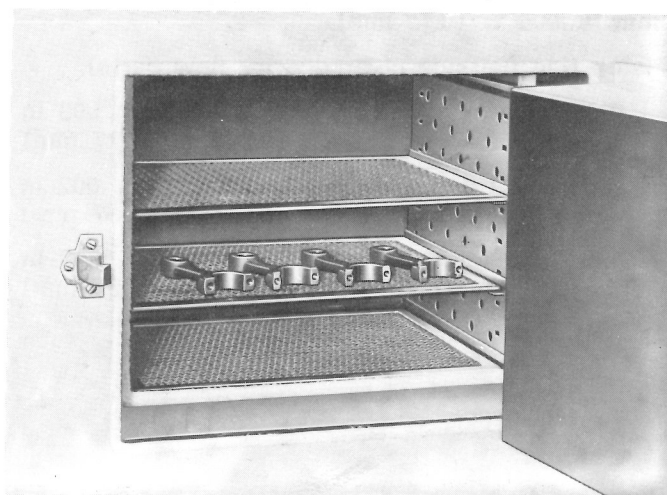
1. Press shaft
2. Driver A. 60379
3. Piston - rod assembly
4. Piston pin
5. Support of tool A. 95615



ASSEMBLY OF PISTON - ROD ASSEMBLY

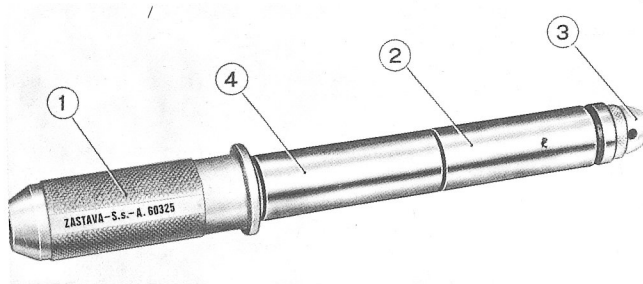
Since the pin is press fitted into the rod the rod must be expanded by heating. The rod should be heated to a temperature of 464°F (240°C).

Place rod, small end first, in an oven with a thermostat. Heat the rod to temperature specified.



Slide the selected wrist pin over the shaft (1) of tool A. 60325 and install pilot (2) on the shaft end. Lock it in place with screw (3). Tighten screw (3) finger tight only to prevent it from becoming stuck to the tool when the pin expands from coming into contact with the heated rod.

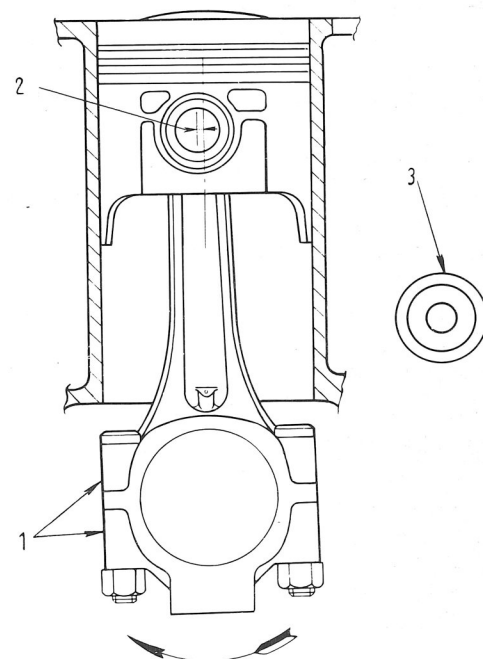
1. Shaft of tool
2. Pilot bushing
3. Stop screw
4. Piston pin



CAUTION: The piston pin bore is offset .080 in (2 mm) Position the connecting rod so that the number (1) stamped on the rod faces towards the side of the pin bore offset.

1. Location of cylinder matching number
2. Piston bore offset [.080 in (2 mm)]
3. Auxiliary shaft

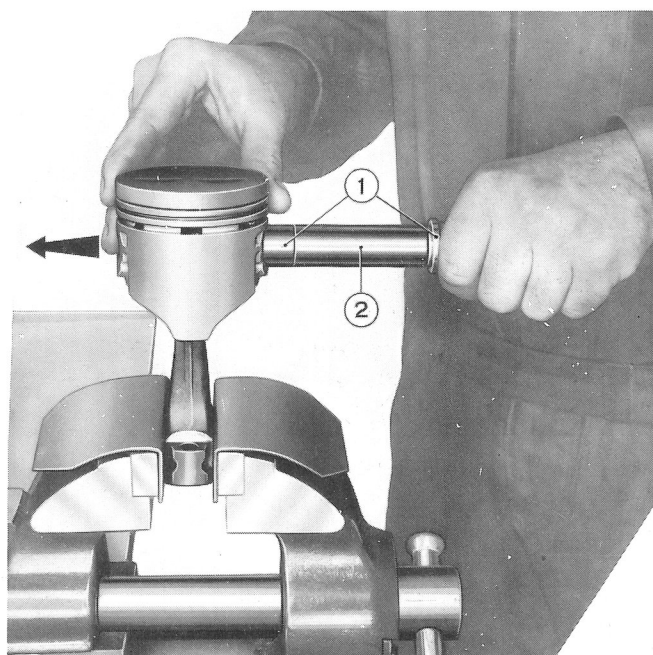
Arrow shows direction of engine rotation



Take the rod out of the oven and quickly clamp it in a vise. Place the piston over the small end of the rod. Make sure it is positioned as specified above.

Line up the pin bore with the small end. Then take tool A. 60325 with the piston pin on it and insert it into the boss and small end until the shoulder of the tool bottoms against the piston boss.

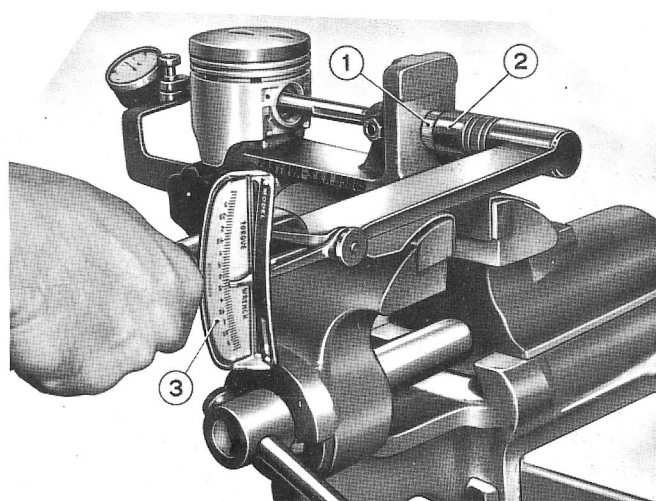
1. Tool A. 60325
2. Piston pin



Checking Fit of Pin in Rod

After the connecting rod, pin, and piston have been assembled, check pin fit in the small end using a torque wrench and tool A. 95615. Torque is 9,4 Ft. lbs (1,3 kgm) that corresponds to axial force 880 Lbs. (400 kg.).

1. Threaded rod nut
2. Socket — torque wrench



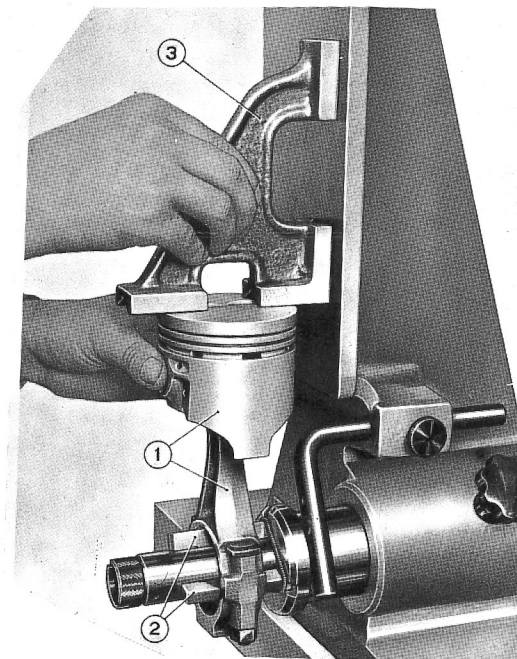
Checking Alignment and Installation of Piston-Rod Assembly in Cylinder

Misalignment of the rod axis is detectable by checking the amount of clearance between the square and the vertical surface of the tool. Maximum allowable misalignment, at distance of 4.92 in (125 mm) from the rod shank is $\pm .004$ in (± 0.10 mm).

Oil the piston pin through the holes in the piston boss.

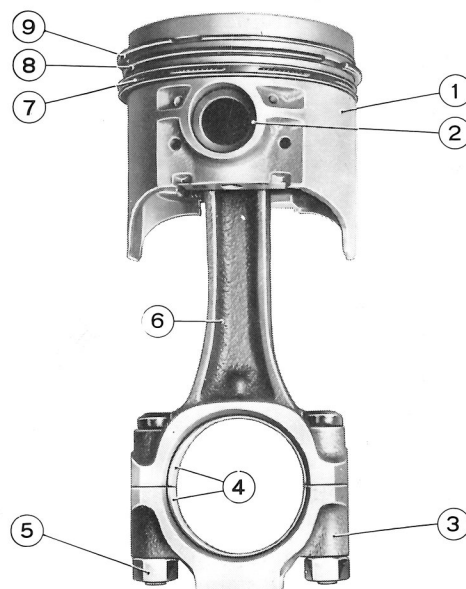
When installing the assembly, make sure the numbers on the connecting rod are on the side away from the auxiliary shaft.

1. Assembly
2. Expandable blades
3. Square gauge



Piston rod assembly.

1. Piston
2. Pin
3. Connecting rod cap
4. Bearing inserts
5. Cap nut
6. Connecting rod shank
8. Oil ring
9. Compression ring

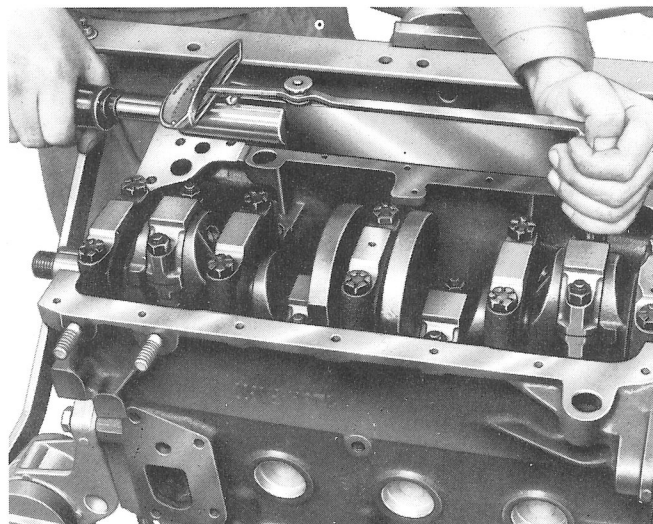


CONNECTING ROD BEARINGS

If there is evidence of deep scoring or excessive wear, replace the bearing inserts (2).

Check for correct clearance between inserts and journals with »Plastigage«.

Clean parts thoroughly. Place a length of plasti-gage wire (1) along journal. Install the caps (3) and torque the nuts to 38 ft. lbs. (5.2 kgm).

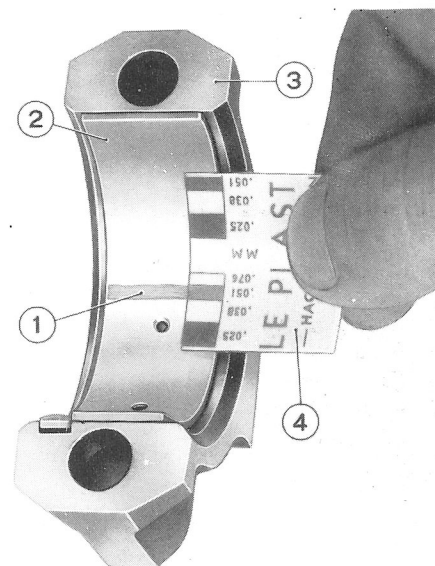


Remove the caps and measure the width of compressed wire using the scale on the envelope (4). If clearance is between .0014 to .0034 in. (0.036 to 0.086 mm), bearing inserts are fit for service.

If clearance is in excess of limits, bearing inserts should be replaced with undersize inserts.

Journals must be ground to an undersize to restore the clearance of .0014 to .0034 in. (0.036 to 0.086 mm). (Refer to ROD JOURNAL DIAMETERS table in CRANKSHAFT — MAIN BEARING section).

1. Plastigage
2. Bearing insert
3. Rod cap
4. Measuring envelope



CONNECTING ROD BEARING THICKNESSES

Standard	Undersizes				
	.005 in (0.127 mm)	.010 in (0.254 mm)	.020 in (0.508 mm)	.030 in (0.762 mm)	.040 in (1.016 mm)
.0603 in (1.531 mm)	.0627 in (1.595 mm)	.0653 in (1.658 mm)	.0703 in (1.785 mm)	.0753 in (1.912 mm)	.0803 in (2.039 mm)
.0606 in (1.538 mm)	.0631 in (1.602 mm)	.0656 in (1.665 mm)	.0706 in (1.792 mm)	.0756 in (1.919 mm)	.0806 in (2.046 mm)

CYLINDER HEAD

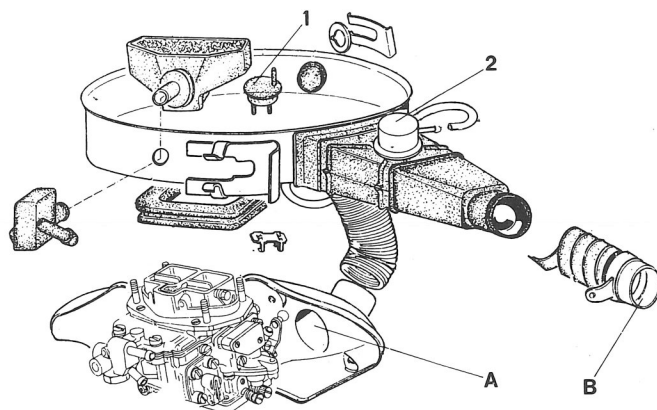
REMOVAL AND INSTALLATION

Cylinder head removal with engine in car is necessary when inspection indicates malfunctions with the cylinder head components which are not serious enough for engine removal.

Disconnect the positive battery lead at the battery. Drain cooling system. Remove spare tire from engine compartment.

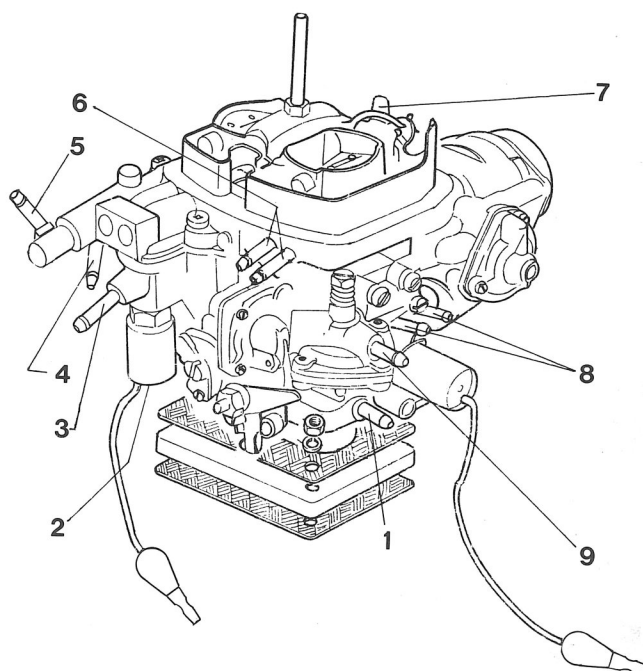
NOTE: Mark lines, hoses, and wires before removal to identify them for installation. Plug all hoses and connections to prevent dirt entry.

Disconnect the flexible hose for the air cleaner from front of car. Disconnect the hoses from bottom of the air cleaner. Remove the air cleaner housing.



Disconnect the accelerator cable from the carburetor. Disconnect the wires from the carburetor choke and shut off solenoid.

Disconnect the fuel supply and return lines from the carburetor. Disconnect the vacuum fuel evaporative hoses from the carburetor and the intake manifold.



Remove the carburetor.

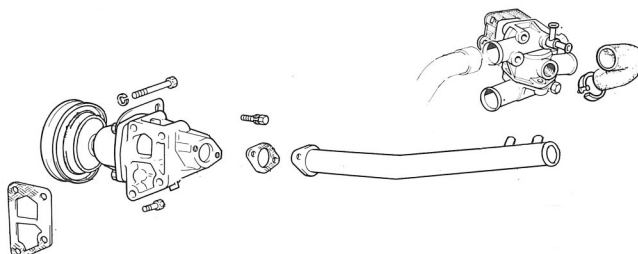
Remove the thermostat housing from the head. Coolant hoses can remain attached to the housing.

Remove the timing belt cover.

Remove the air pump and support.

Disconnect the coolant hose from the cylinder head outlet.

Remove the alternator without disconnecting the wires. Lay the alternator to one side.



Loosen the tensioner pulley and remove the timing belt from cam sprocket. Remove the belt shield.

Disconnect the exhaust pipe from the manifold.

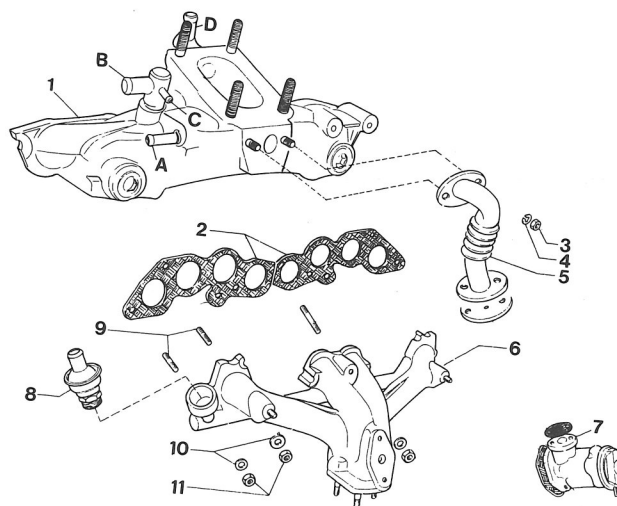
Disconnect the EGR line at the valve and manifold.

Disconnect the spark plug wires. Disconnect the wires from the cylinder head sending units.

Remove the cylinder head hold down bolts.

Remove the cylinder head with intake manifolds.

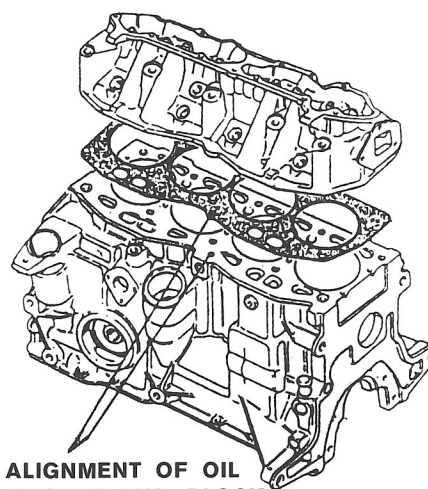
Installation is the reverse of removal.



NOTE: Place the head gasket on the block surface right side up (print marks on upper side), so the gasket is aligned with the lubrication passage from the block to the head.

NOTE: 1986 engines w/12mm head bolts (19mm hex): these bolts are installed clean and dry.

1987 engines w/10mm head bolts (17mm hex): lubricate all bolts and washers with engine oil. Let excess oil drip from bolts and washers for 30 minutes.

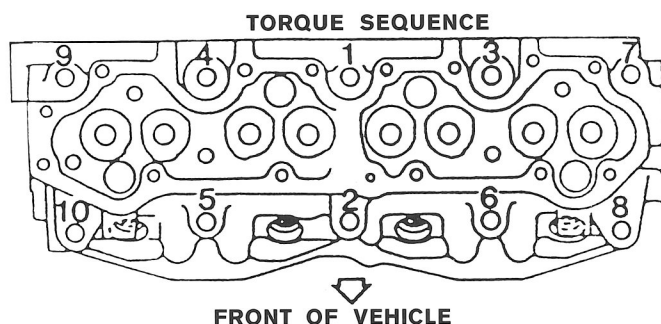


CHECK ALIGNMENT OF OIL HOLES IN GASKET AND BLOCK

Tighten and torque the cylinder head bolts in stages using the sequence shown in the illustration.

1st stage, tighten to 15 ft. lbs. (2 kgm).

2nd stage, tighten to 30 ft. lbs. (4 kgm).



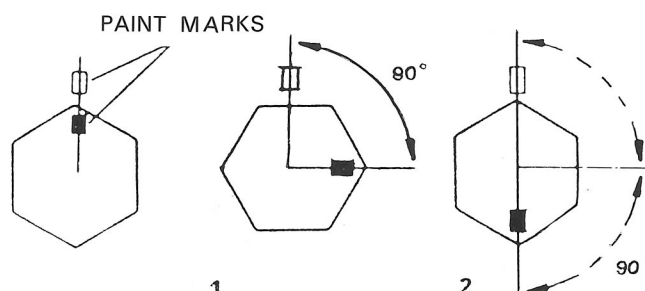
NOTE: 1986 engines: Torque to 69 ft. lbs. (9.5 kgm) using tool A. 50131. These bolts should be retorqued after 1,000 miles.

1987 engines: Apply a paint mark to one corner of each head bolt and a corresponding mark on the cylinder head.

Using wrench A. 50172, tighten all bolts 90° (1).

Then tighten all bolts to a second 90° (2).

All cylinder head bolts must be tightened a total of 180° in two stages as shown.



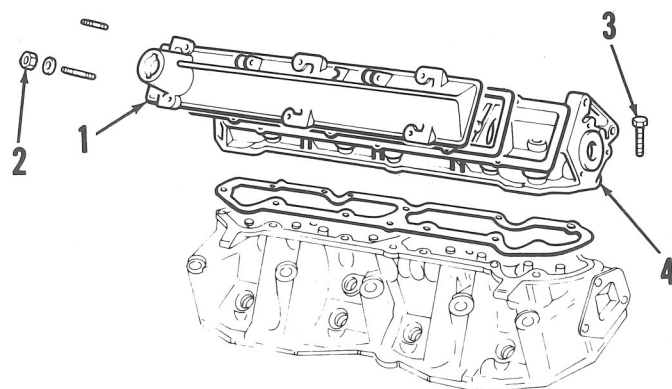
DISASSEMBLY AND REASSEMBLY

Remove the camshaft housing cover (1) by removing six nuts (2).

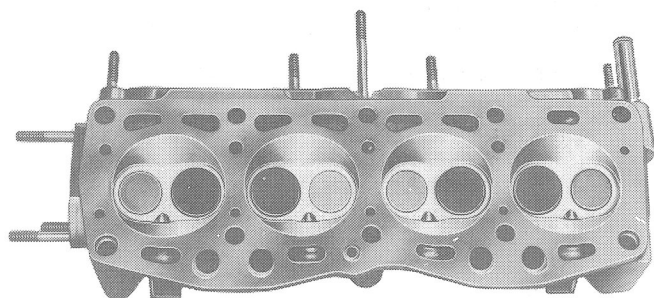
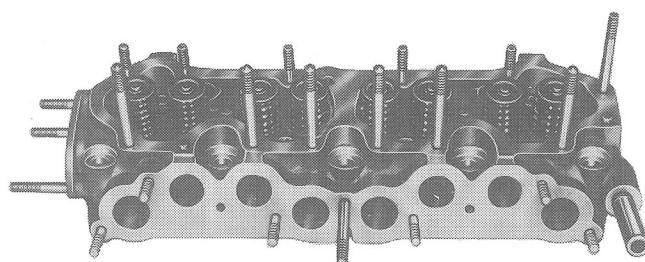
Remove the camshaft housing (4) from the cylinder head by removing twelve bolts (3).

Remove the intake and exhaust manifolds.

1. Camshaft housing cover
2. Nut
3. Bolt
4. Camshaft housing



NOTE: Loosen the camshaft housing bolts in stages to allow the gradual release of the valve spring pressure against the camshaft. When lifting the camshaft housing from the head, be careful that the tappets stay in position in their bores, and do not fall out and become mixed up or damaged.



Remove the spark plugs.

Place cylinder head on holder A. 60442.

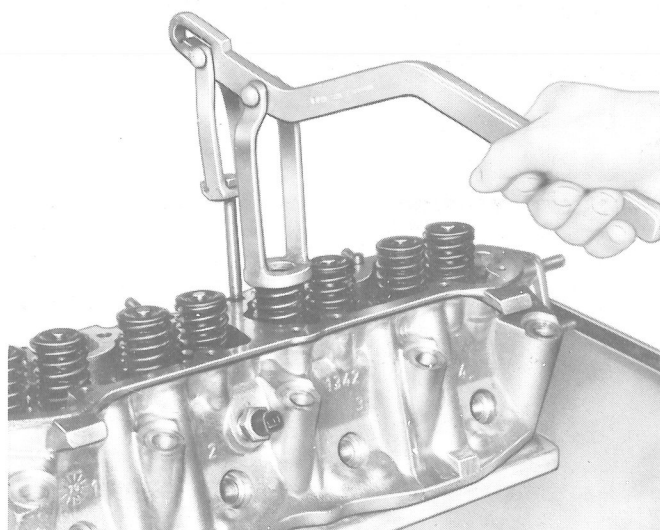
Position the valve spring compressor A. 60311 as shown. Compress spring to release spring locks (if spring locks are stuck in their grooves, carefully tap the spring cups, taking care not to damage the valve stem).

Remove the locks, cups and springs.

Remove the oil seals from the valve guides and take out valves from bottom side of the head.

Before reassembling head, see installing valve stem seals and cleaning and inspecting the head in the following text.

To reassemble the head, reverse the above procedure.



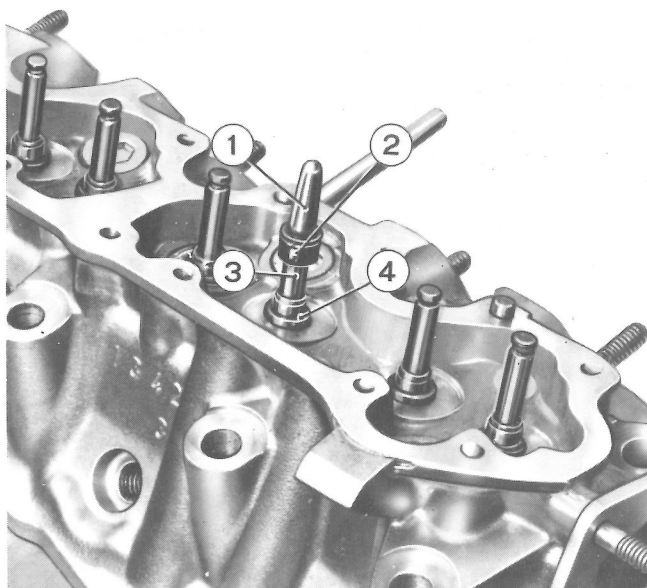
Valve Stem Seals

Before installing the valve spring, install the valve stem seals (2) on the valve guides (4) with pilot A. 60313 (1).

Place oil seal on pilot and mount pilot on valve stem.

Press seal down onto upper end of valve guide with installer A. 60313/2.

1. Pilot A. 60313/1
2. Oil seal
3. Valve stem
4. Valve guide

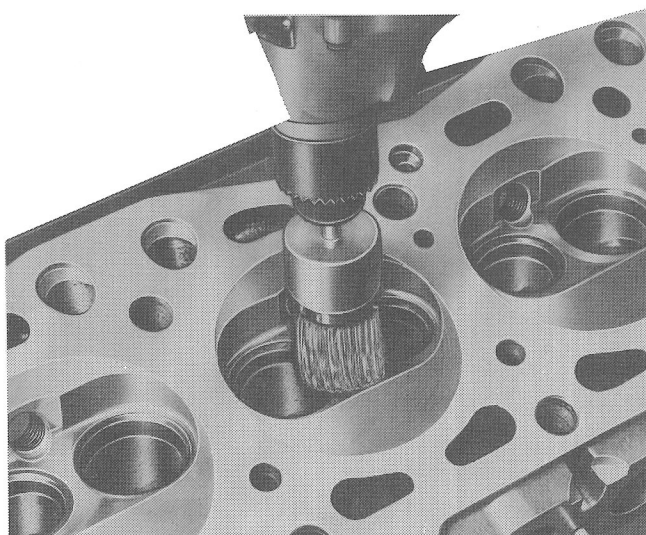


Cleaning Cylinder Head

Clean carbon from the combustion chambers using a wire brush driven by a portable electric drill.

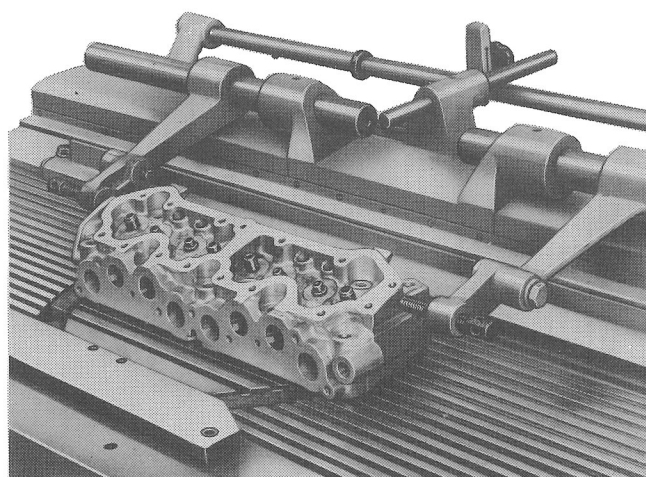
Remove carbon deposits from the exhaust ports and descale the water jackets.

Inspect and clean the intake ports and oilways to camshaft lobes and tappets.



Inspecting and Refacing Gasket Surface

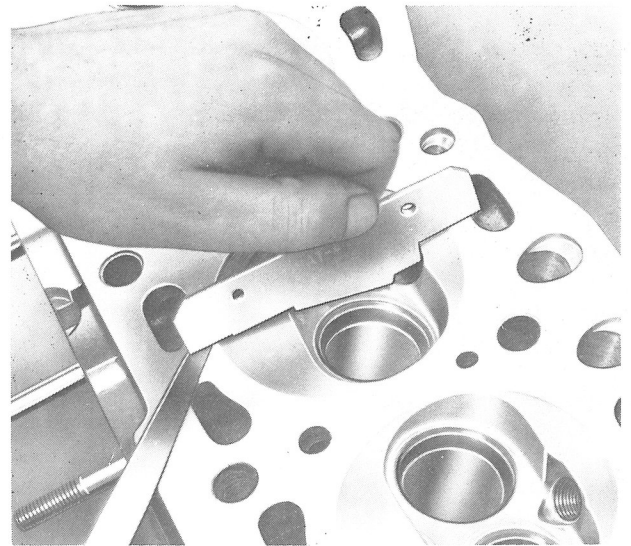
The head surface may be checked with a straight edge and feeler gauge. Maximum allowable warpage is .004 in (0.1 mm). If the head must be resurfaced, remove only enough stock to correct the warpage.



After refacing, combustion chamber depth must be checked with gauge A. 96223 to make sure it has not been reduced beyond allowable limits.

With gauge resting at the center of the combustion chamber, the gap between the gauge and the gasket surface should not exceed .010 in. (0.25 mm). If gap exceeds this, replace head.

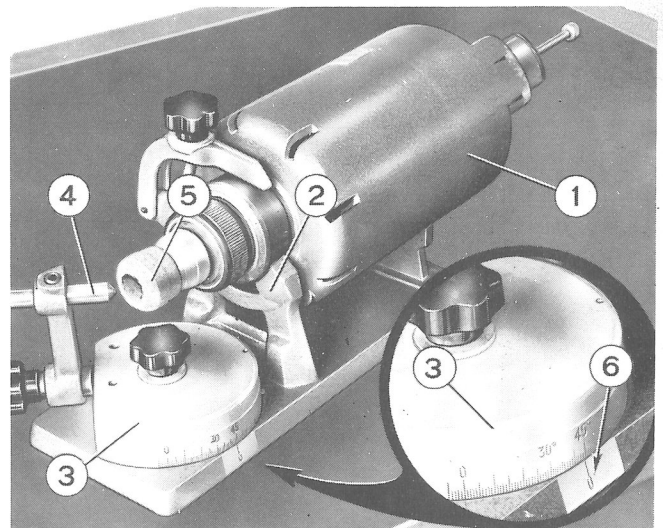
1. Depth gauge A. 96223
2. Feeler gauge



REFACING VALVE SEATS

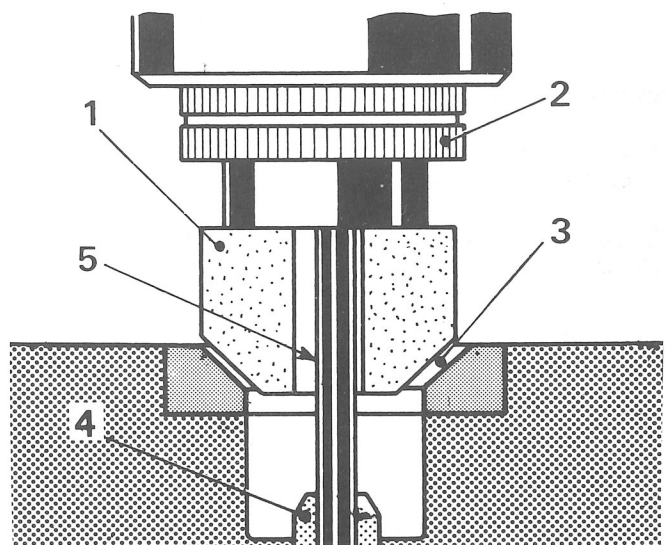
The valve seats on the cylinder head must show no evidence of damage within the contact zone with valves. If they do, reface them as follows:

NOTE: It is a good practice to frequently dress the working surfaces of the grinding stone. Use an electric grinding stone on a device with a graduated scale in degrees in order to get the grinding stone to the required angle.



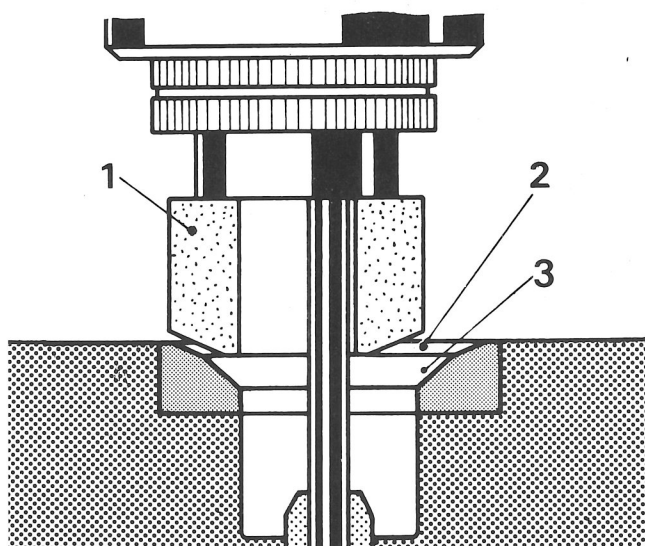
Reface valve seat using a tapered stone with an angle of $44^{\circ} 30'$.

1. Stone ($44^{\circ} 30'$)
2. Electric grinder
3. Valve seat (45°)
4. Valve guide
5. Centering mandrel



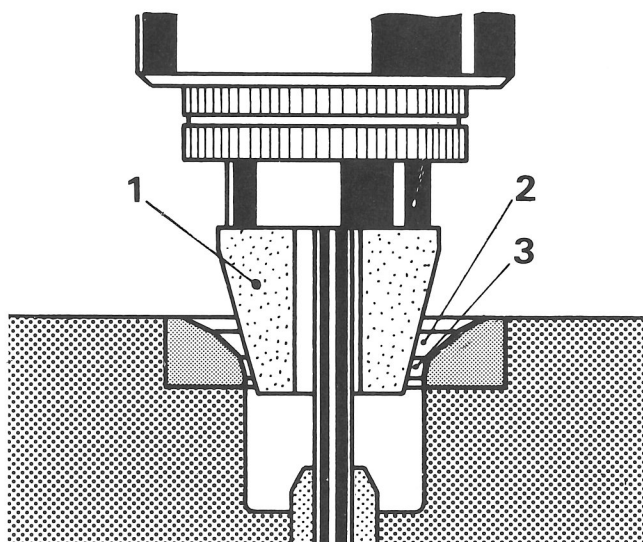
Once valve seat has been refaced, narrow valve seat at the top with a 20° grinding stone.

1. 20° grinding stone
2. Phase shifting at angle of 20°
3. Valve seat at angle of 45° narrowed at top



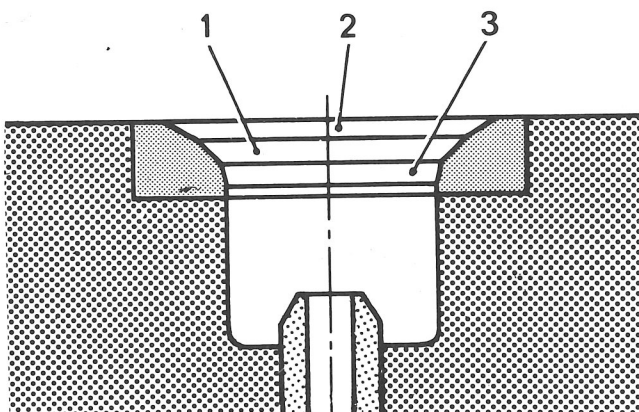
Narrow the valve seat at the bottom with a 75° grinding stone.

1. 75° grinding stone
2. Phase shifting at angle of 75°
3. Valve seat at angle of 45° narrowed at top and bottom



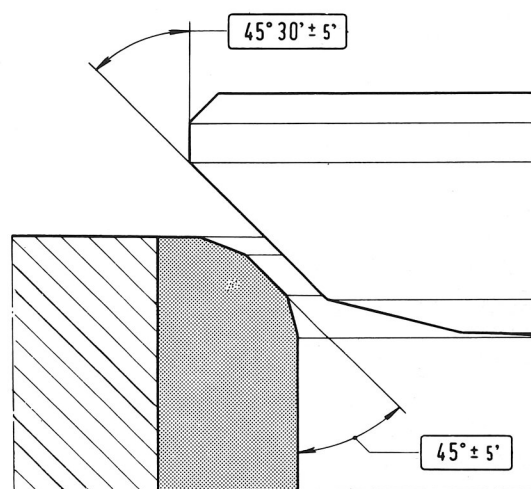
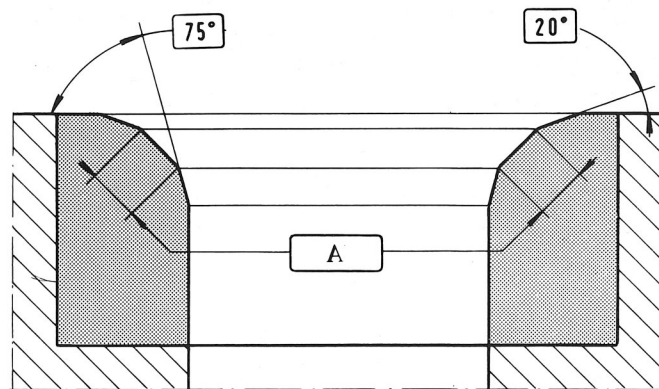
Finished valve seat

1. Valve seat
2. Narrowed valve seat with 20° grinding stone
3. Narrowed valve seat with 75° grinding stone



Valve seats in cylinder head

A — Valve seat width is .080 in (2 mm)

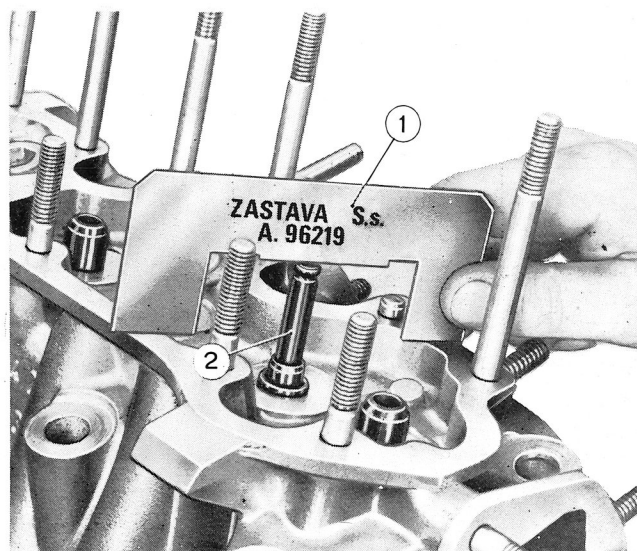
**VALVES****INSPECTING AND REFACING VALVES**

Clean carbon from valves with power wire brush. Inspect valve stem for distortion and signs of cracking, replace valve if necessary.

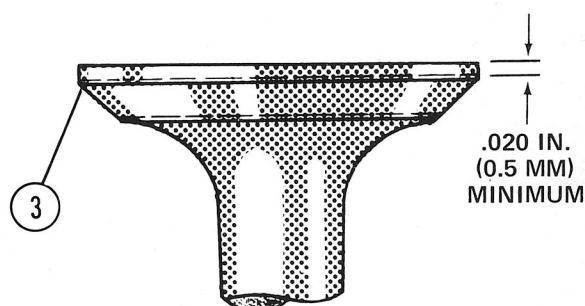
Serviceable valve may be refaced at angle of $45^\circ \pm 5'$. At completion of refacing, check that thickness of valve head margin (3) is at least .020 in. (0.5 mm).

Should it become necessary to grind stem tip to eliminate dishing due to wear or to reduce stem height after refacing, remove only what is necessary.

With each valve reinstalled in its seat, use gauge A. 96219 (1) to check that stem (2) tip just grazes the gage. If there is any interference between stem and gauge reduce stem height by grinding tip.



1. Gauge A. 96219
2. Valve stem
3. Valve head margin

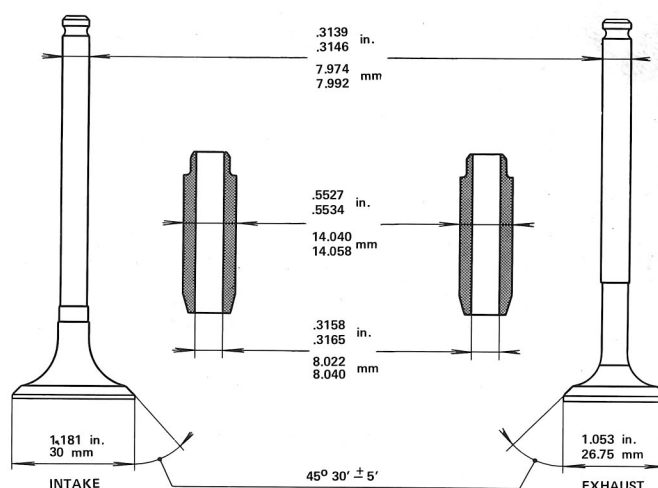


INSPECTING AND REPLACING VALVE GUIDES

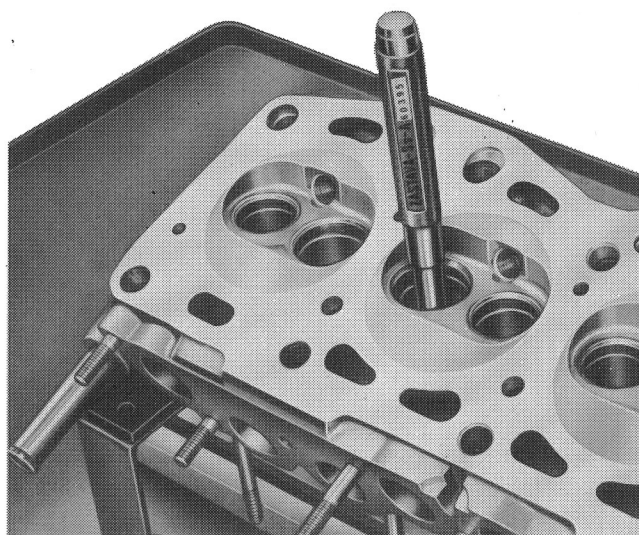
Valve guides are press fitted in their bores with an interference fit of .0025 to .0043 in. (0.063 to 0.108 mm).

They should be replaced when scored or worn or when there is excessive clearance between them and the valve stem, which cannot be corrected by replacing valve.

Valve stem fit clearance in guide is for both intake and exhaust, valves, and maximum wear limit is .006 in (0.15 mm).

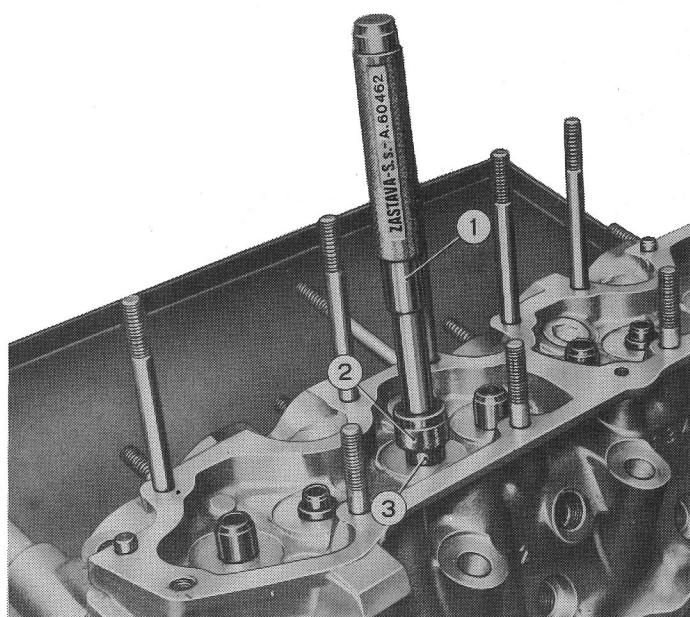


When replacing the valve guides, use driver A. 60395 for disassembly.



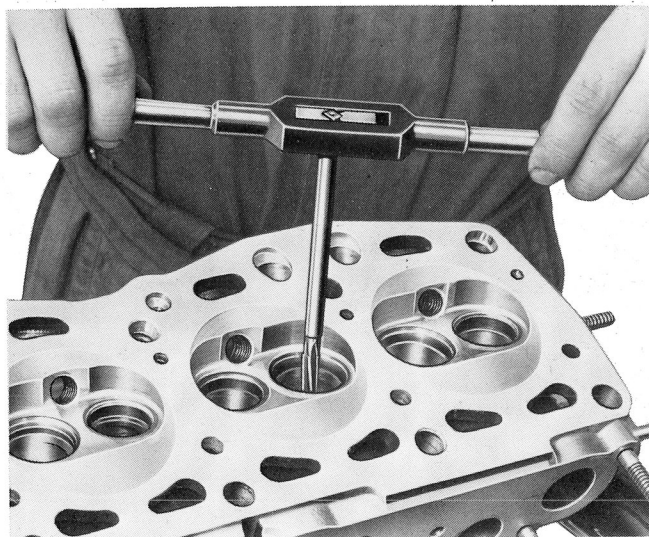
Install the valve guides using driver A. 60462.

1. Driver A. 60462
2. Detail of driver
3. Valve guide



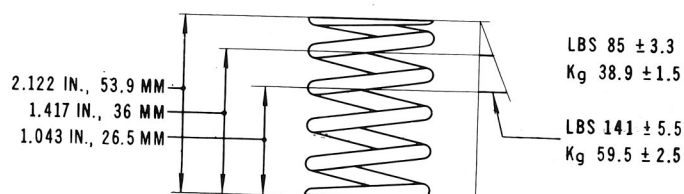
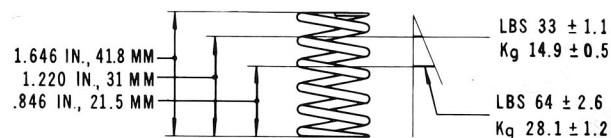
NOTE: Valve guides are available for service with their inner diameter prefinished to size. They do not have to be refinished except in cases where the press fitting operation has caused a minor fault. Should damage occur, use reamer A. 90310 to refinish bore.

The outer diameter of service guides is .008 in (0,2 mm) oversize.

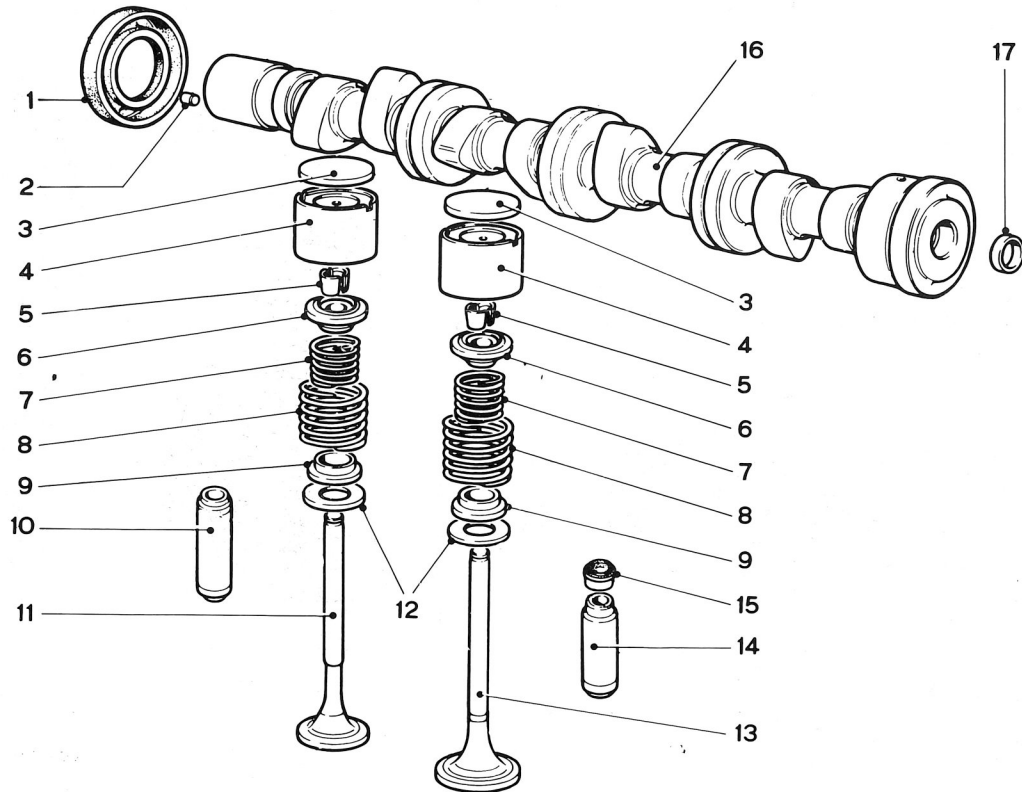


VALVE SPRINGS

Inspect the valve springs for cracks or weakening. Test the spring tension using appropriate spring tester. Then compare tension and deflection data on tester with specifications shown.



VALVE MECHANISM



Exploded view of valve mechanism components

- | | | |
|---|-------------------------|------------------------|
| 1. Seal | 7. Inner springs | 13. Intake valve |
| 2. Dowel | 8. Outer springs | 14. Intake valve guide |
| 3. Plates for adjusting valve clearance | 9. Lower cups | 15. Oil seal |
| 4. Tappets | 10. Exhaust valve guide | 16. Camshaft |
| 5. Locks | 11. Exhaust valve | 17. Welch plug |
| 6. Upper cups | 12. Flat washers | |

CAMSHAFT HOUSING

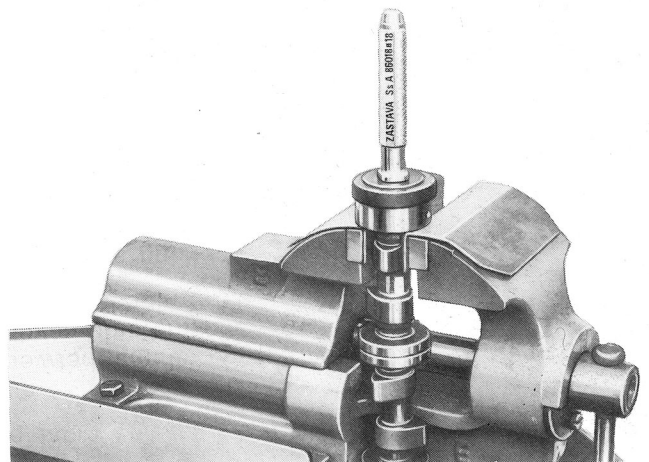
Check that the camshaft bores in the housing are not out of-round. Check that inner surfaces are smooth and show no signs of seizure. If necessary, replace housing.

NOTE: When servicing the camshaft it is advisable to replace the drive-end seal.

CAMSHAFT

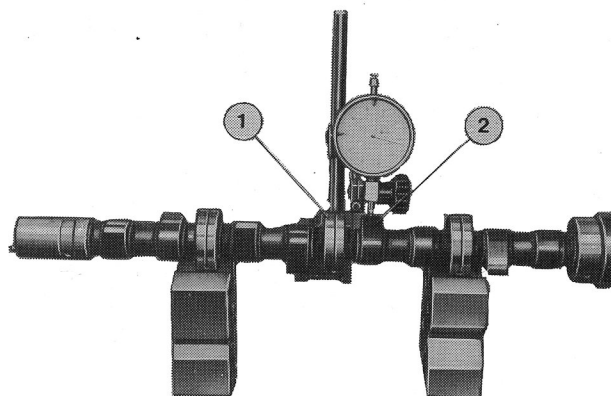
Check that the camshaft journal and lobe surfaces are absolutely smooth and in perfect condition. If traces of seizure or scoring are found, camshaft is not fit for further service and should be replaced.

Make sure journal oil holes are not plugged. To remove camshaft welch plug, use a standard punch. To reinstall the welch plug, use installer A. 86018.



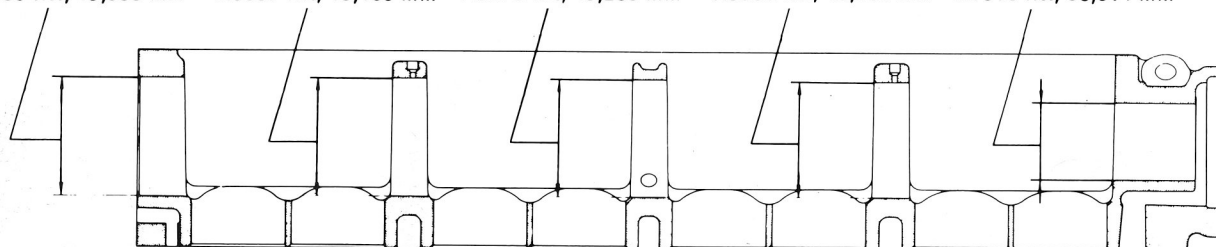
Rest the camshaft on two parallel blocks placed on a surface plate. Using a dial gauge, check that the center journal (1) runout does not exceed .008 in. (0.2 mm). Also check that lobe height (2) is 0.362 in. (9.2 mm) for intake and .346 in. (8.8 mm) for exhaust lobes.

1. Center journal
2. Cam lobe

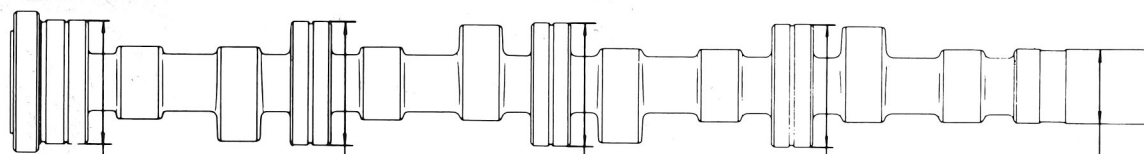


SPECIFICATION OF CAMSHAFT AND BORES IN HOUSING

1.9126 IN., 48,580 MM	1.9047 IN., 48,380 MM	1.8968 IN., 48,180 MM	1.8890 IN., 47,980 MM	1.1807 IN., 29,989 MM
1.9136 IN., 48,605 MM	1.9057 IN., 48,405 MM	1.8976 IN., 48,205 MM	1.8900 IN., 48,005 MM	1.1816 IN., 30,014 MM



1.9114 IN., 48,550 MM	1.9035 IN., 48,350 MM	1.8957 IN., 48,150 MM	1.8878 IN., 47,950 MM	1.1795 IN., 29,960 MM
1.9108 IN., 48,535 MM	1.9030 IN., 48,335 MM	1.8951 IN., 48,135 MM	1.8872 IN., 47,935 MM	1.1787 IN., 29,944 MM



TAPPETS AND SHIMS

Make sure shim surface in contact with camshaft lobes is glass-like and shows no signs of dishing or pitting. Minor imperfections can be removed using an extra fine abrasive stone.

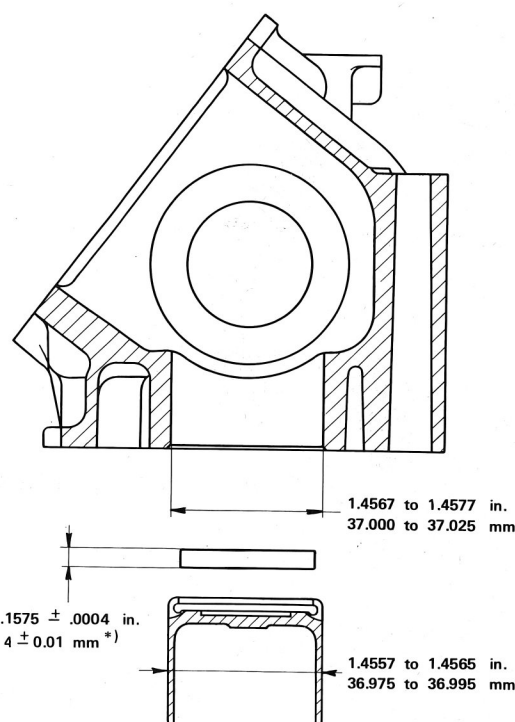
Tappet outside surfaces, and tappet bores in the camshaft housing should not show evidence of undue wear, taper or scoring.

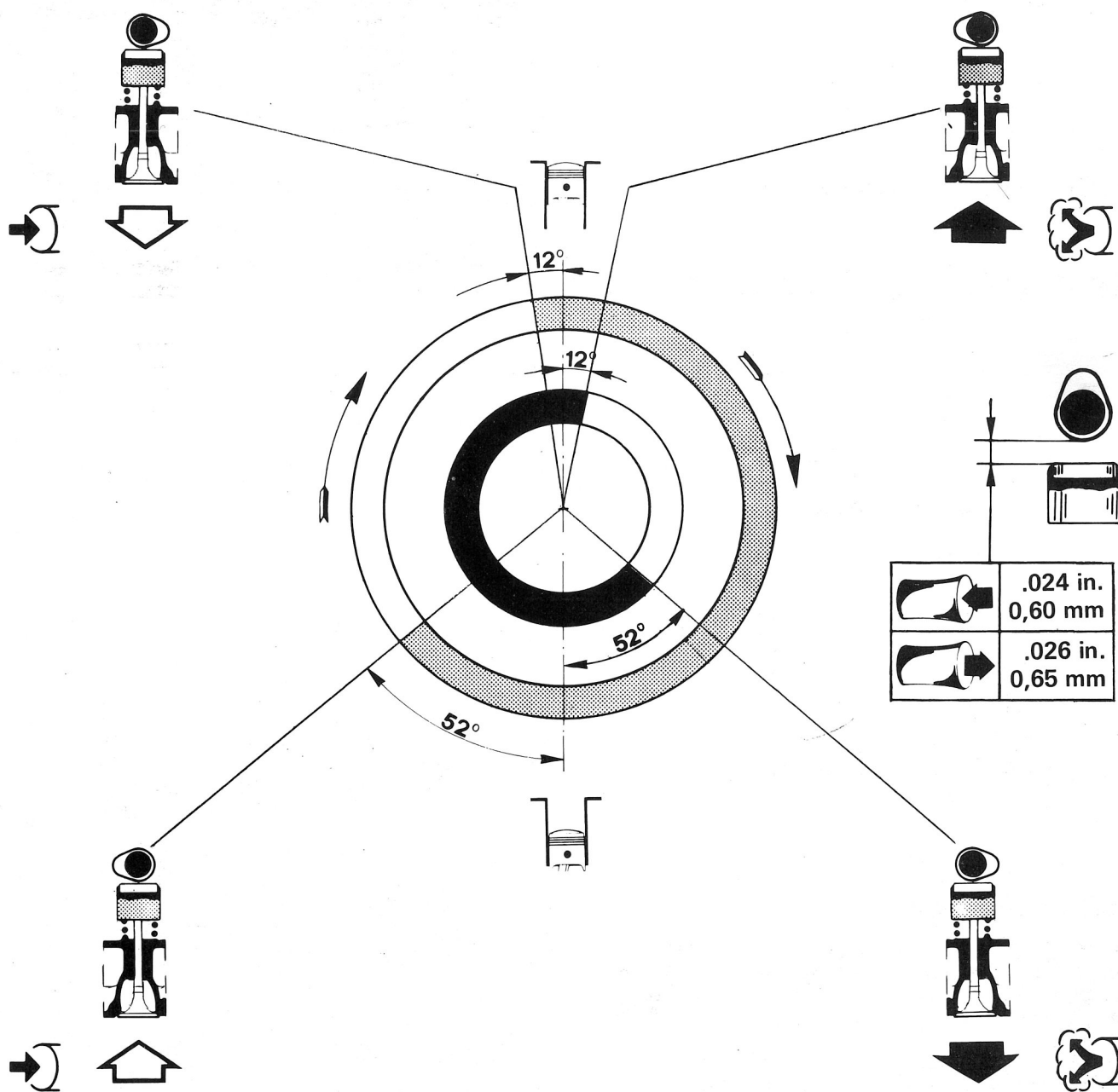
Check the tappet diameter and tappet bore diameter in the camshaft housing using micrometers. Values read on micrometers should meet specification as shown: If they do not, replace worn parts.

Shims are available for service in a range of thickness from .128 to .185 in. (3.25 to 4.70 mm) with .002 in. (0.05 mm) increments.

(*) Standard thickness of basic shim.

.1575 \pm .0004 in (4 \pm 0.01 mm)*





Valve timing diagram referred to clearance between cam and tappet

- Intake 024 in (0,60mm)
— Exhaust 026 in (0,65 mm)

CHECKING AND ADJUSTING VALVE CLEARANCE

Adjustment of clearance between camshaft lobes and tappets does not require camshaft removal. Correct clearance with engine cold is:

Intake valves = .0157 in. (0.40 mm)

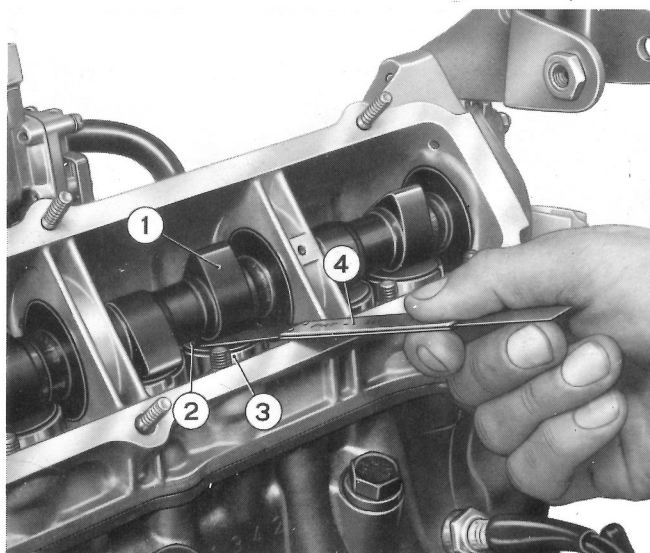
Exhaust valves = .0190 in. (0.50 mm)

Remove the camshaft cover.

Turn the crankshaft until lobe (1) controlling tappet (3) being checked is pointing upwards and is at right angles to tappet plate (2).

Using a feeler gauge (4), measure the clearance between the shim and camshaft lobe.

1. Lobe 2. Shim 3. Tappet 4. Feeler gauge.



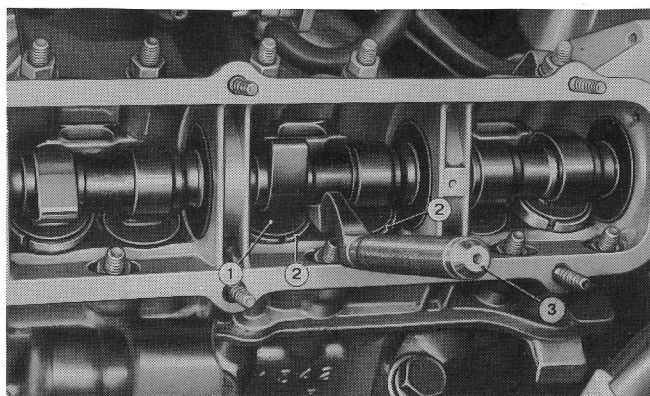
NOTE: Remove oil from around tappets with syringe to simplify shims removal. Empty syringe into oil drain passages.

If clearance is not as specified, insert tool A. 60421 (3) on both intake and exhaust valve tappets (2). Remove plate (1) from its seat on tappet using pliers A. 87001.

After determining needed thickness, install new shim.

Tappet clearance shims are available for service in a range of thicknesses from .128 to .185 in. (3.25 to 4.70 mm) with a difference between each of .002 in (0.05 mm). The thickness of the shim is shown on one of the flat surfaces and this should be assembled towards the tappet.

1. Shim to be removed
2. Tappets lowered by tool
3. Tool A. 60421



Valve Timing

Use the following procedure for timing valves:
Temporarily install timing belt cover.
Turn crankshaft until timing mark (4) on the crankshaft pulley is aligned with index (5) on timing belt cover.

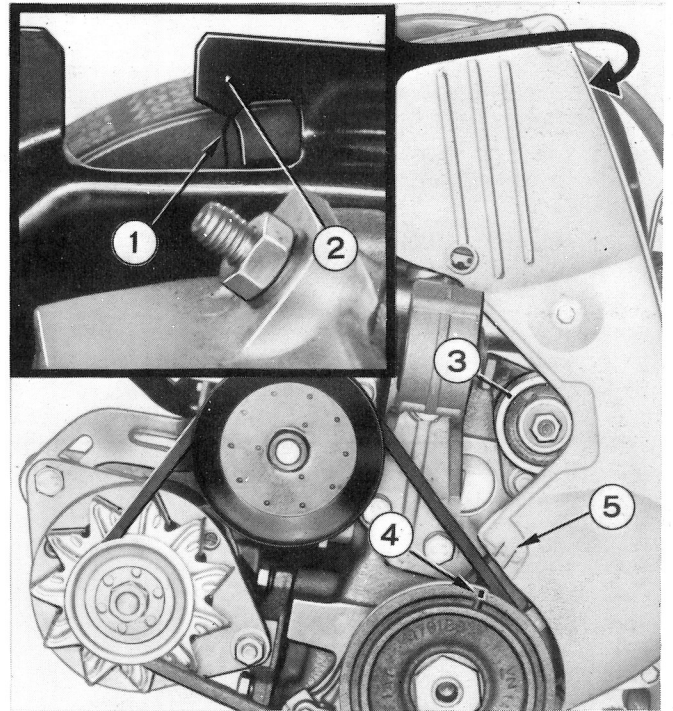
Turn the camshaft sprocket and align index mark (1) on the back of the sprocket with index mark (2) on the timing belt shield.

Move the belt tensioner (3) in order to compress the spring and secure it in place.

Install the timing belt with the slack on the tensioner side. Make sure the timing belt teeth are perfectly coupled with the sprockets.

Loosen the nut holding the tensioner pulley and the tensioner will tighten the belt. Torque the tensioner pulley nut in this position to 33 ft. lbs. (4.5 kgm).

Install timing belt cover and check that the timing marks are still correct after installing the timing belt.



1. Camshaft sprocket timing mark 2. Timing mark on belt shield 3. Tensioner 4. Timing mark on crankshaft pulley 5. Timing mark on timing belt cover

Replacing Timing Belt (Engine in Car)

Use the following procedure to replace the timing belt:

Remove the timing belt cover (the lower retaining screw of the cover must be removed from under the car after removing the right guard).

Check the timing by aligning the timing mark on the back of the camshaft sprocket (1) with the timing mark (2) on the shield. Timing mark (4) on the crankshaft pulley should coincide with timing mark (5) on the cover.

Apply the hand brake and engage a low gear to prevent the crankshaft from rotating.

Loosen upper nut (6) and the alternator-to-bracket bolt (8) and remove the drive belt.

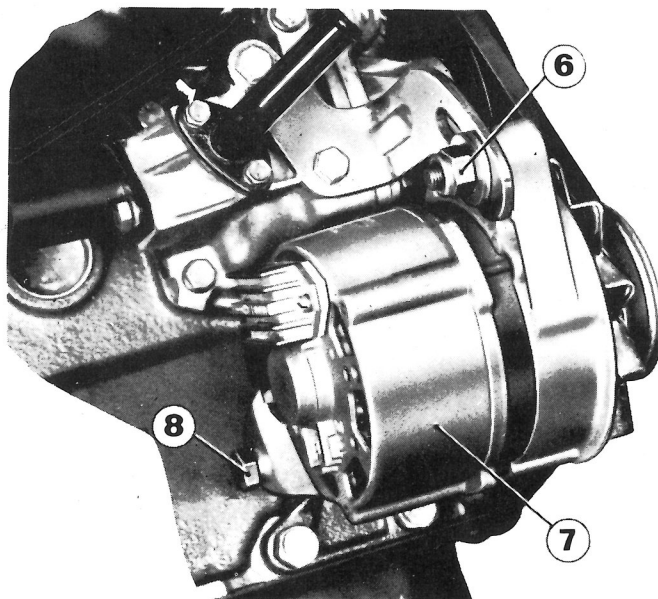
Loosen the tensioner (3) retaining nut and move the tensioner toward the engine mount and tighten the nut to hold it there. Remove the timing belt with the slack on the tensioner side.

Install the new timing belt. Make sure the timing belt teeth are perfectly coupled with the sprockets.

Loosen the nut holding the tensioner and the tensioner will tighten the belt. Torque the tensioner nut in this position to 33 ft. lbs. (4.5 kgm). Check that the timing marks are still correctly aligned. Install the alternator drive belt and adjust its tension to about 1/2 inch deflection with moderate finger pressure.

Install the timing belt cover.

Check and if necessary, adjust ignition timing.

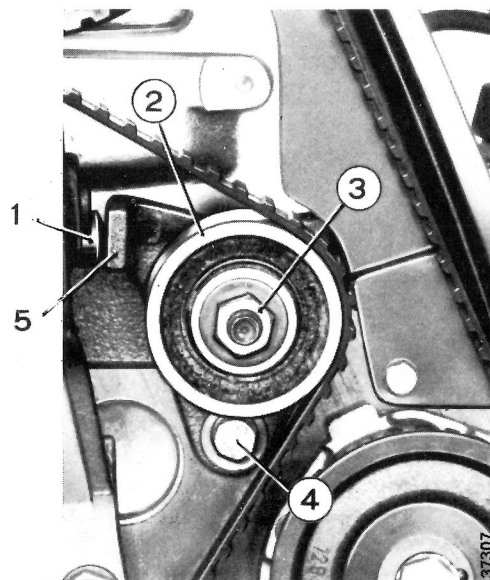


If it becomes necessary, to replace the tensioner remove the belt, pulley nut (3), and screw (4).

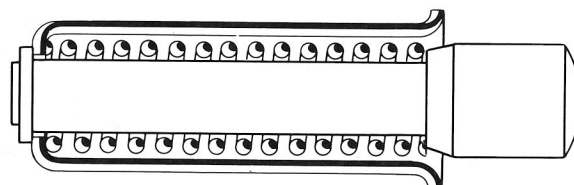
Then slide the tensioner assembly from its housing in the engine mount.

To reinstall, reverse the procedure.

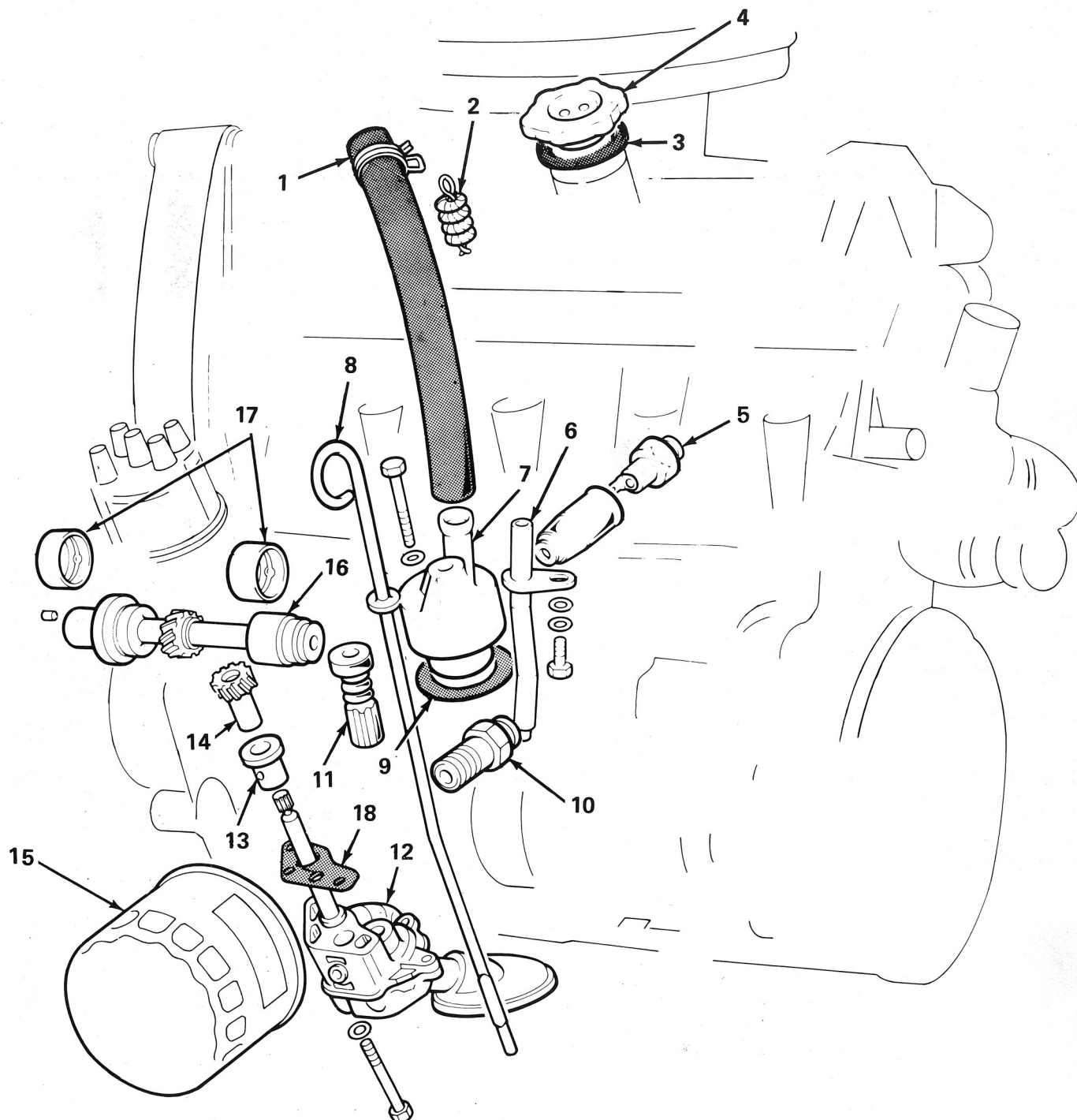
1. Tensioner
2. Tensioner pulley
3. Pulley nut
4. Support bolt
5. Support



NOTE — The tensioner (shown here) is supplied for service as an assembly; its components are not available separately.



LUBRICATION lubrication system components

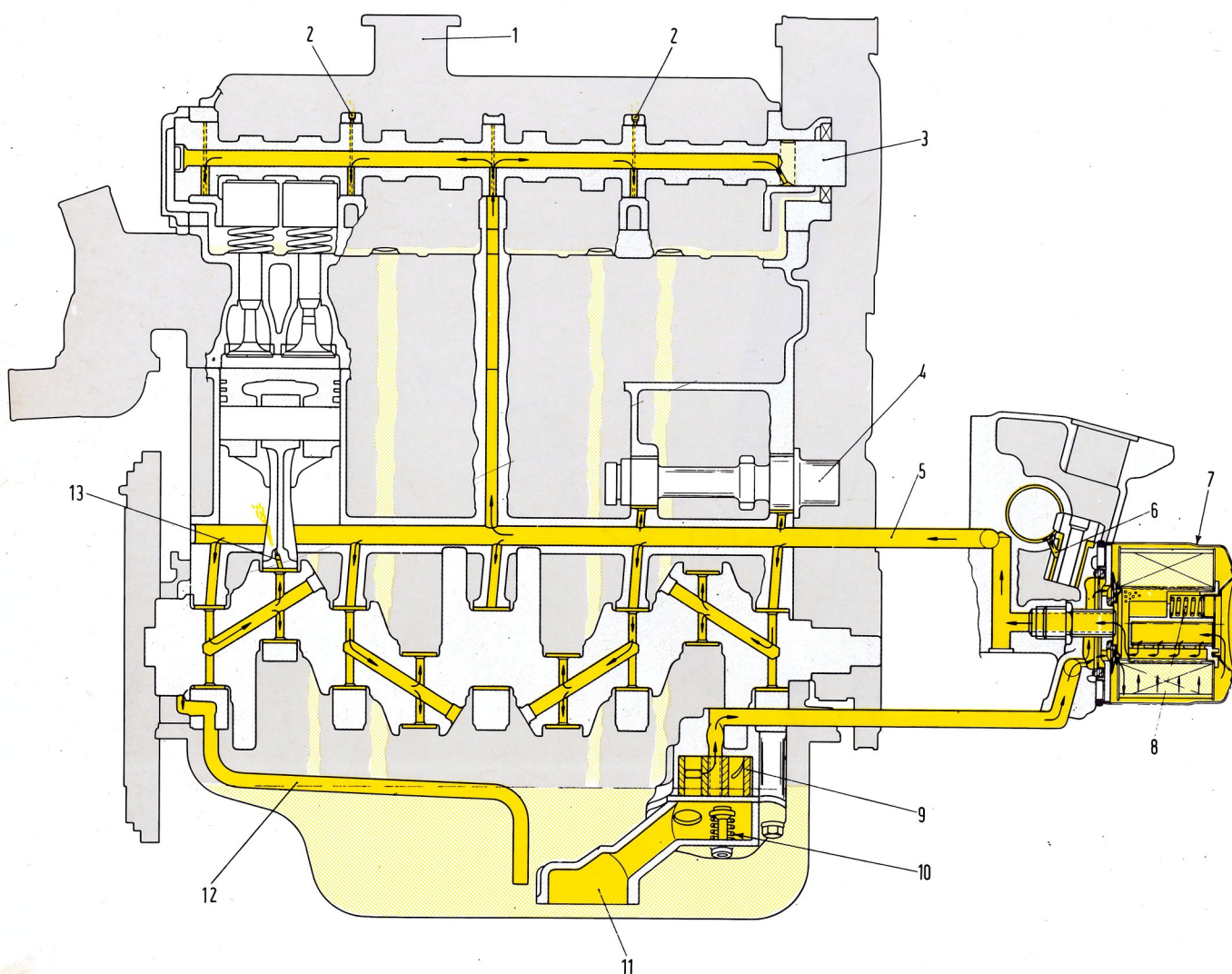


1. Breather hose
2. Flame trap
3. Seal
4. Oil filler cap
5. Oil pressure sender
6. Oil return pipe

7. Cyclonic trap
8. Dipstick
9. Gasket
10. Oil filter union
11. Dipstick seal
12. Oil pump

13. Bushing
14. Oil pump drive gear
15. Oil filter
16. Auxiliary shaft
17. Bushings
18. Gasket

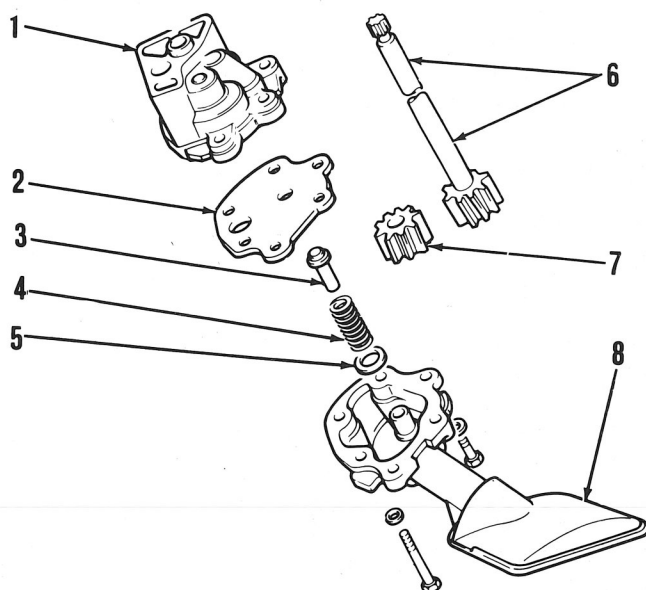
Engine lubrication diagram



- | | | |
|---|---|---|
| 1. Oil filler | 5. Main oil gallery | 9. Oil pump |
| 2. Oil spray outlets for camshaft lobes and tappets | 6. Oil pump and distributor drive gear oil duct | 10. Oil pressure relief valve |
| 3. Camshaft | 7. Full-flow oil filter | 11. Oil pump suction pipe |
| 4. Auxiliary shaft | 8. By-pass valve | 12. Oil return pipe |
| | | 13. Oil spray outlet for cylinder walls |

Oil Pump Assembly

1. Pump housing
2. Cover plate
3. Pressure relief valve
4. Spring
5. Washer
6. Drive gear
7. Driven gear
8. Oil intake pickup



Removal and Installation (Engine in Car)

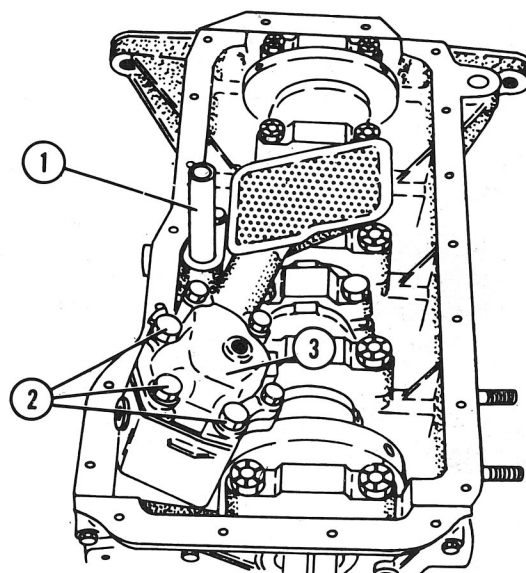
Drain the oil pan. Remove the bolts and washers holding the oil pan to the engine and remove the pan.

Remove three bolts (2) and washers holding oil pump (3). Remove the pump and gasket. Installation is the reverse of removal.

When installing the pump, make sure it is seated before tightening the bolts.

Clean the pan gasket surface thoroughly. Install all new gaskets.

1. Oil return pipe
2. Bolt
3. Oil pump



Inspection

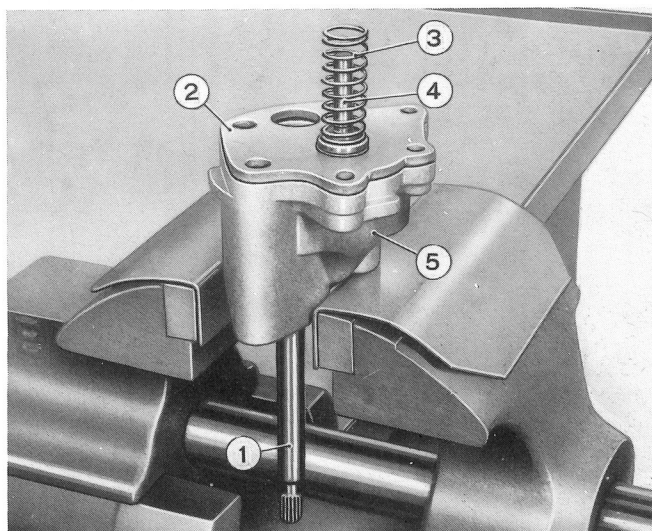
Carefully clamp the pump body in a vise. Remove the three bolts holding the pickup housing to the pump housing (5) and remove the pickup.

Remove spring (3), relief valve (4), and cover (2). Slide the drive shaft with the drive gear and driven gear out of the housing.

Clean all disassembled parts in solvent and blow dry them with compressed air.

Check the housing and cover for cracks. Check the intake pickup and oil duct for clogging. Blow them clear with compressed air.

1. Pump shaft
2. Cover
3. Spring
4. Relief valve
5. Pump housing



Examine the gears for wear.

Check backlash between the gears. Backlash is .006 in. (0.15 mm) when the pump is new. Maximum allowable backlash is .010 in. (0.25 mm).

Check the gear tooth to pump housing clearance with a feeler gauge as shown. The clearance ranges from .004 to .007 in. (0.11 to 0.18 mm) on a new pump. Maximum allowable clearance is .010 in. (0.25 mm).

Replace the housing and the gears if clearances are exceeded.

Check the clearance between the gears and the cover mating face.

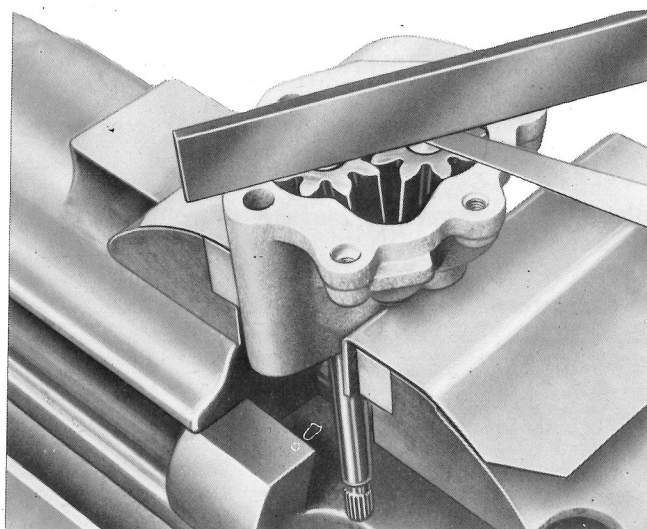
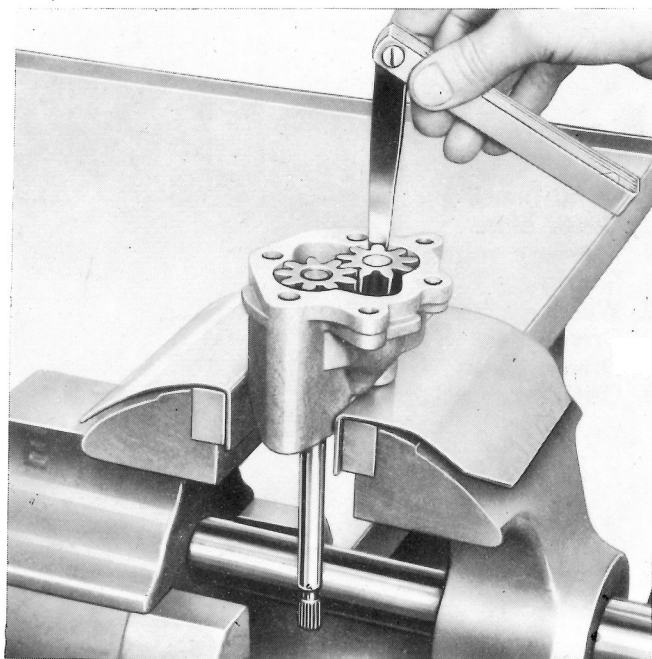
Using a straightedge and feeler gauge as shown, clearance range should be .0008 to .0041 in. (0.020 to 0.105 mm). If a value of more than .006 in. (0.15 mm) is found, either the gears and/or the pump housing must be replaced.

To determine if the gears are worn, measure their length. The range for new gears is 1.101 to 1.102 in. (27.967 to 28.000 mm).

The drive gear is mounted on its shaft with an interference fit. Check for signs of play.

Clearance between the driven gear and its shaft is .0006 to .002 in. (0.017 to 0.057 mm). Maximum allowable clearance is .004 in. (0.10 mm).

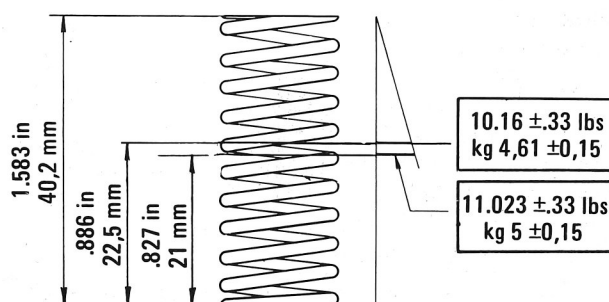
Check clearance between the pump drive shaft and pump housing. Clearance range is .0006 to .002 in. (0.017 to 0.057 mm). Maximum allowable clearance is .004 in. (0.10 mm).

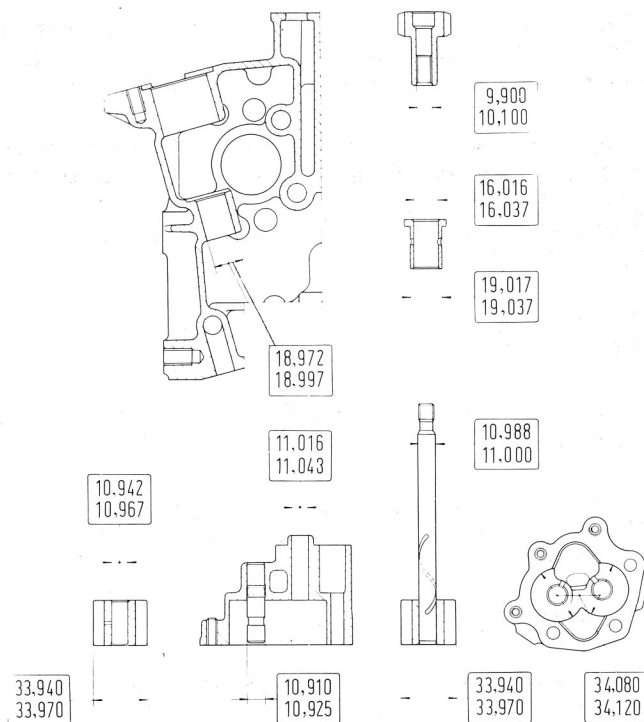
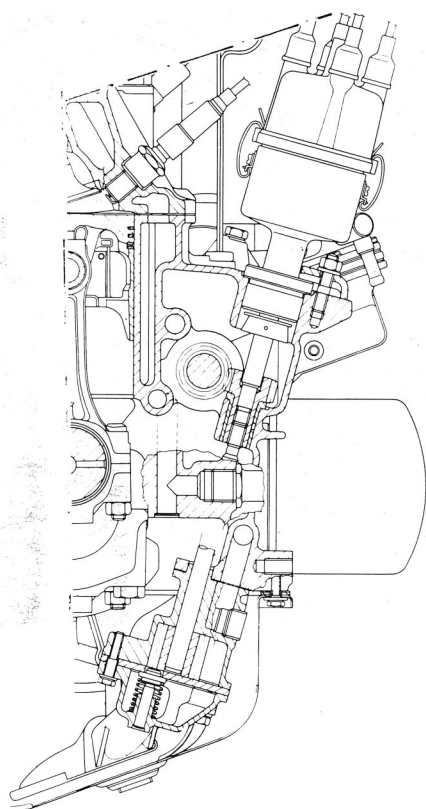


Relief Valve Inspection

The relief valve should be carefully cleaned and inspected.

NOTE: — Make sure that all dirt and residue is removed from between the valve and pump housing, otherwise the valve may stick. Check that the valve spring load performance is as shown.





.3898 in. = 9,900 mm
 .3976 in. = 10,100 mm
 .4295 in. = 10,910 mm
 .4301 in. = 10,925 mm
 .4308 in. = 10,942 mm
 .4318 in. = 10,967 mm
 .4326 in. = 10,988 mm
 .4331 in. = 11,000 mm
 .4337 in. = 11,016 mm
 .4347 in. = 11,043 mm

.6305 in. = 16,016 mm
 .6314 in. = 16,037 mm
 .7469 in. = 18,972 mm
 .7479 in. = 18,997 mm
 .7487 in. = 19,017 mm
 .7495 in. = 19,037 mm
 1.3362 in. = 33,940 mm
 1.3374 in. = 33,970 mm
 1.3418 in. = 34,080 mm
 1.3433 in. = 34,120 mm

Cross-section of engine through oil pump showing main data for inspection of pump components and drive assemblies

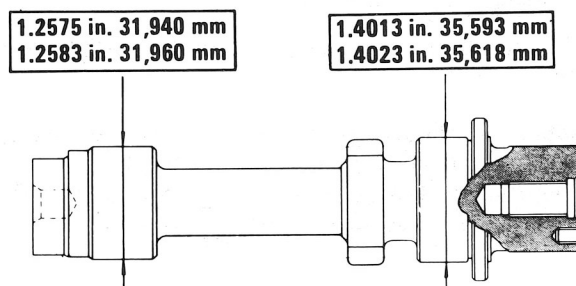
AUXILIARY SHAFT

Inspection

The auxiliary shaft (for oil pump, ignition distributor and fuel pump) should have absolutely smooth journal and fuel pump drive lobe surfaces. If signs of scuffing or scoring are found, which cannot be removed by an extra-fine abrasive stone, replacement of the shaft is recommended.

Inspect the oil pump and ignition distributor drive gear teeth for evidence of chipping or excessive wear. If these are found, replace the shaft and the driven gear.

Check that auxiliary shaft journal diameters conform to the specifications shown above.

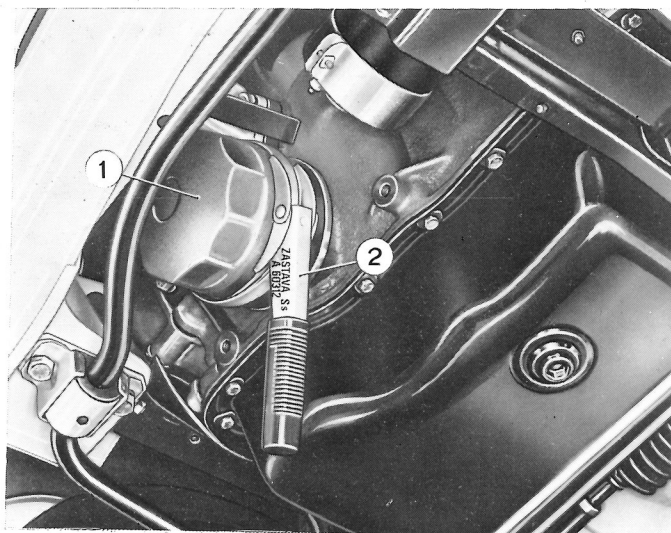


Full-Flow Oil Filter

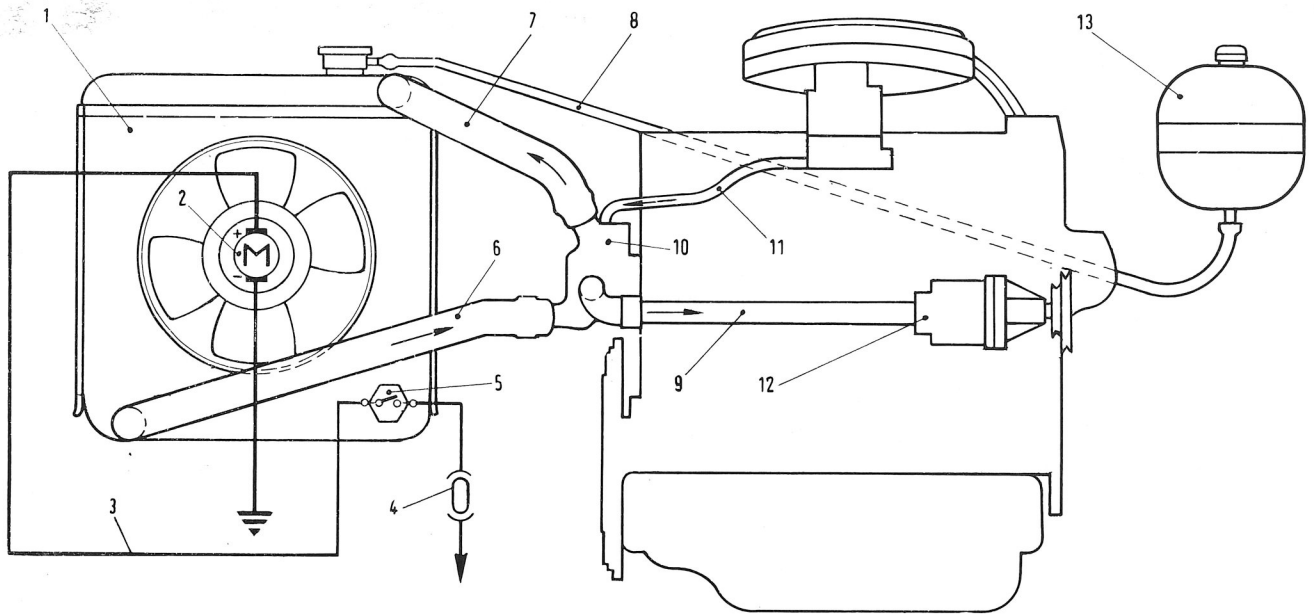
The full-flow oil filter consists of a metal body housing a cartridge type filtering element. The filter is complete with a by-pass valve that cuts out the filtering action if the cartridge is clogged.

Filter efficiency is of particular importance in ensuring satisfactory engine lubrication. It should always be changed every 7,500 miles (12,000 km). Use tool A. 60312 to remove the filter.

1. Filter
2. Tool A. 60312



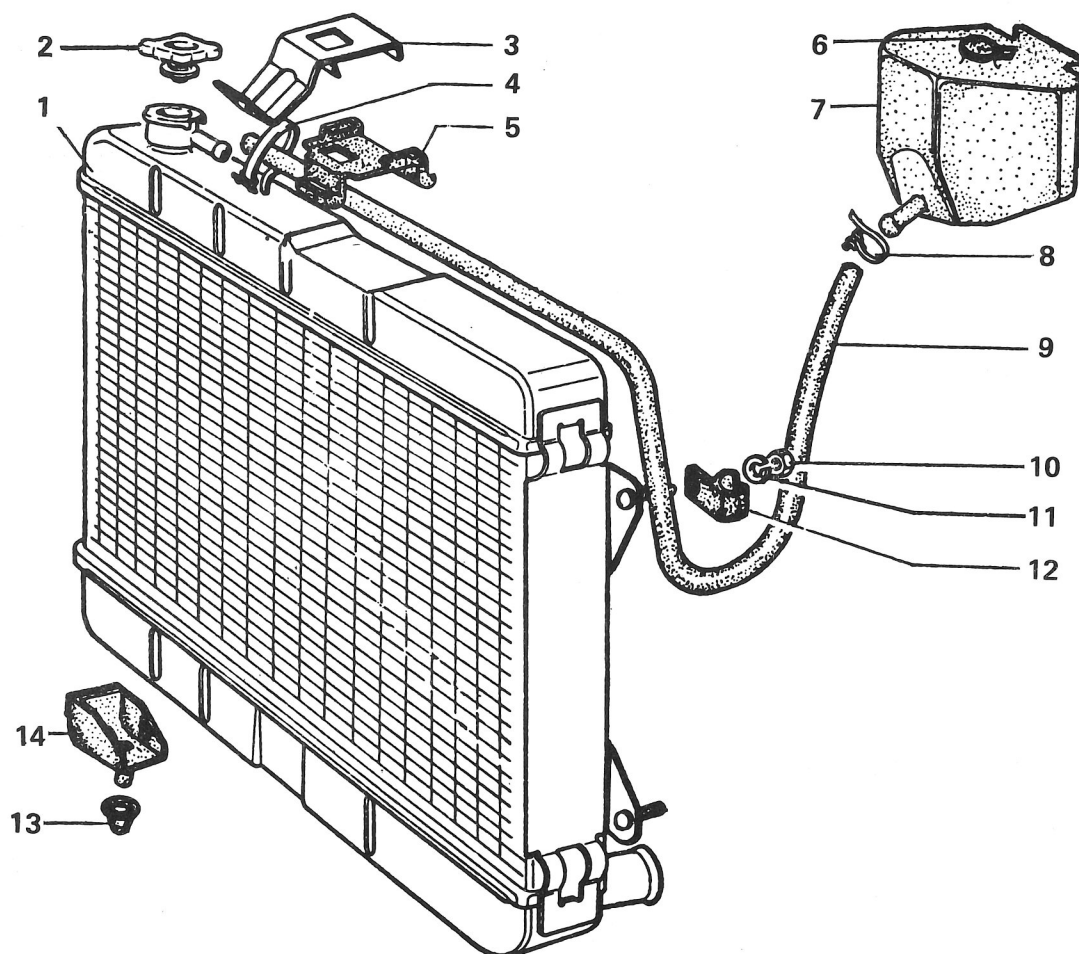
ENGINE COOLING SYSTEM



Engine cooling system operational diagram

- | | |
|-------------------------|---------------------------|
| 1. Radiator | 7. Upper radiator hose |
| 2. Radiator cooling fan | 8. Radiator overflow hose |
| 3. Fan power feed | 9. Pump intake pipe |
| 4. Fan fuse (8 Amp) | 10. Thermostat housing |
| 5. Fan thermal switch | 11. Manifold coolant hose |
| 6. Lower radiator hose | 12. Water pump |
| | 13. Expansion tank |

RADIATOR



1. Radiator
2. Cap
3. Bracket
4. Clamp
5. Gasket
6. Cap
7. Expansion tank

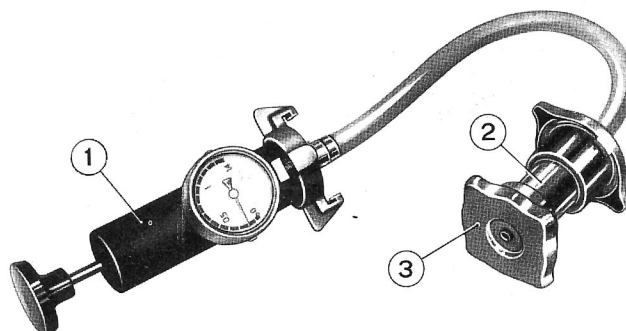
8. Clamp
9. Hose
10. Nut
11. Lockwasher
12. Gasket
13. Pad
14. Pad

Testing

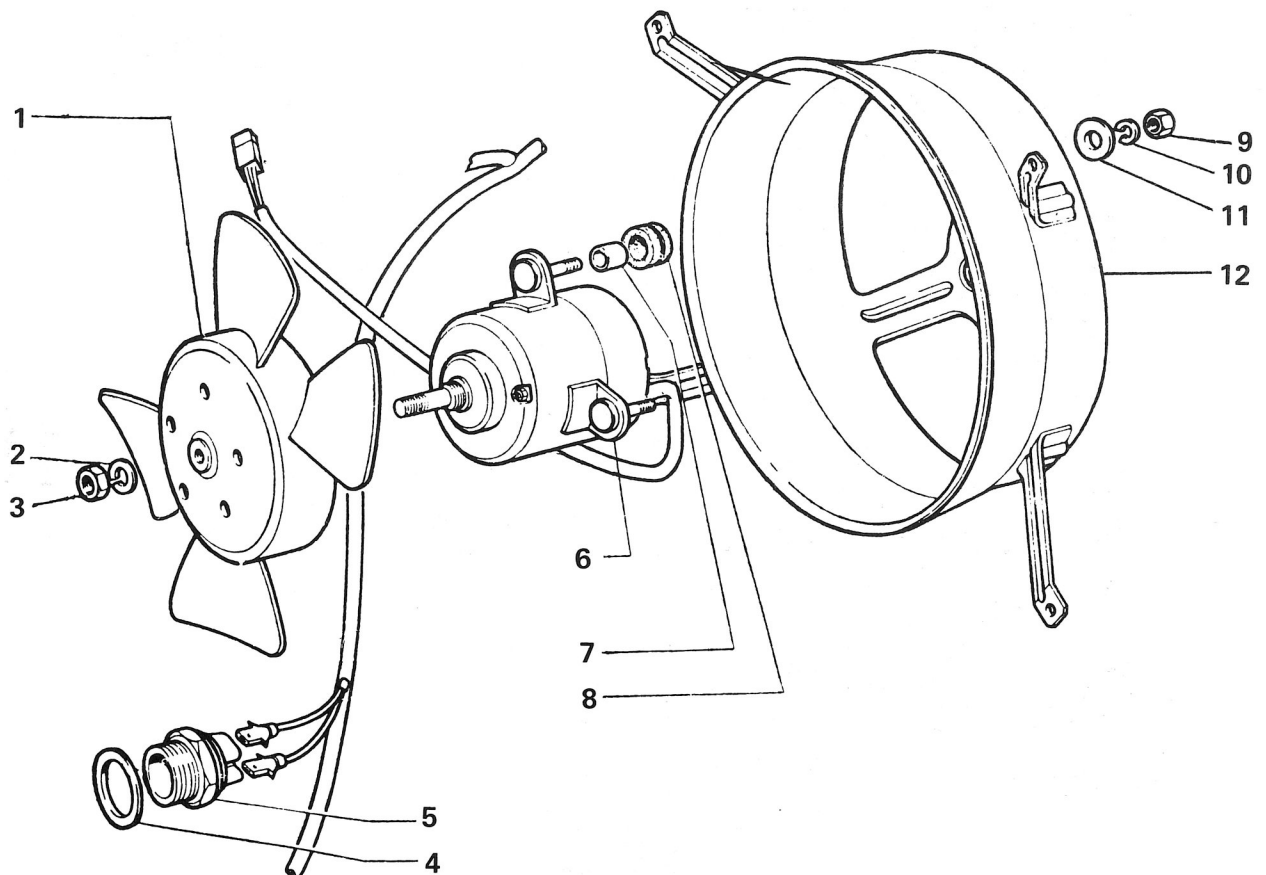
Attach tester (1) to radiator filler neck. Pump in air until pressure of 14,2 psi is built up. If system does not hold pressure, check for leaks.

Test cap (3) by applying pressure with tester as shown. Check that vent valve in cap opens at 11,4 psi.

1. Tester
2. Adaptor
3. Radiator cap



Radiator cooling fan and motor



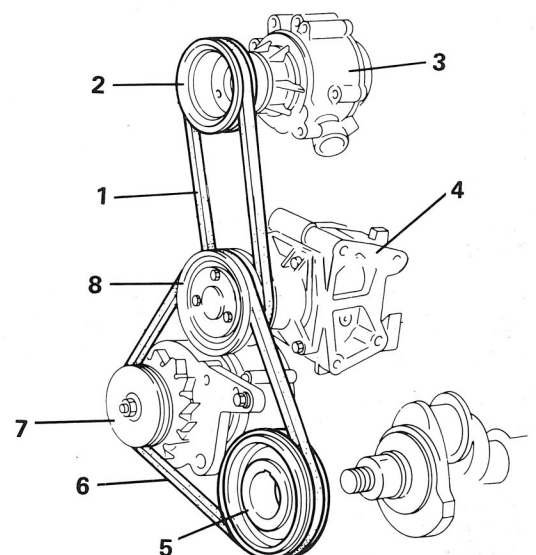
- 1. Fan
- 2. Lockwasher
- 3. Nut
- 4. Gasket
- 5. Thermo switch
- 6. Motor

- 7. Bushing
- 8. Pad
- 9. Nut
- 10. Lockwasher
- 11. Washer
- 12. Shroud

Water Pump and Alternator Drive Belts Replacing and Adjusting.

To replace water pump and alternator drive belt (6), loosen the alternator mounting bolts and remove the belt.

Install the new belt (6) on crankshaft pulley (5), water pump pulley (8), and alternator pulley (7). Fully tighten belt (6) and alternator mount bolts. Check for about 1/2 inch belt deflection with moderate finger pressure.



WATER PUMP

Removal and Installation

Remove the timing belt cover.

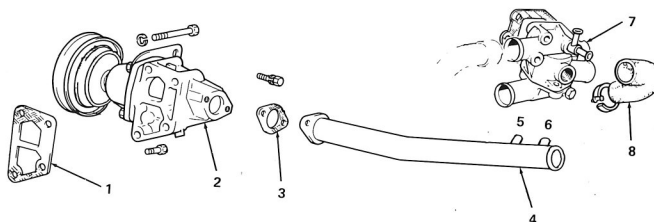
Remove the air pump and drive belt.

Loosen the alternator and remove the drive belt.

Drain off enough water from the radiator to bring the level below that of the water pump.

Remove the two bolts holding the intake pipe (4) to the water pump (3) and disconnect the pipe. Remove the four bolts and lockwashers holding the pump (2) to the engine block. Remove pump (2) and gasket (1).

Installation is the reverse of removal. Use new gaskets.



1. Gasket
2. Water pump
3. Gasket
4. Pipe
5. Vacuum switch connection (4 port)
6. Vacuum switch connection (3 port)
7. Thermostat
8. Hose

Thermostat Housing

Removal and installation

Drain off enough water from radiator to bring level below that of thermostat housing. Remove spare tire.

Disconnect the large hoses and the small hoses from the housing outlets.

Remove three bolts holding the thermostat housing (1) to the cylinder head. Remove housing (1) and gasket.

Installation is reverse of removal. Install new gasket.

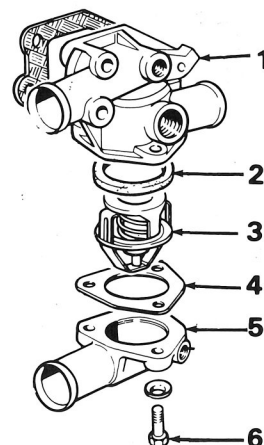
THERMOSTAT

Removal and Installation

Drain off enough water from radiator to bring level below that of the thermostat housing (1).

Remove three bolts (6) and washers holding housing gasket (4), thermostat (3) and seal (2) from housing. Installation is reverse of removal. Use new gaskets.

1. Thermostat housing
2. Seal
3. Thermostat
4. Gasket
5. Housing cover
6. Bolt



BY-PASS THERMOSTAT

A by-pass thermostat is used to maintain an even water temperature inside the engine during the warming-up stage. It is connected to the water pump, the cylinder head and the radiator by means of three rubber hoses.

When the engine is cold, the bottom valve of the thermostat is closed and the water goes through the by-pass (5), the open top valve (1), and the union (4). This arrangement is used to maintain a good supply of water in circulation and thus ensure a uniform distribution of heat throughout the inside of the engine.

When the engine water temperature reaches 179°F ($355 \pm 2\text{ K}$) the bottom valve (2) begins to open and allows a certain amount of cold water from the radiator to mix with that entering from the top valve (1) via the by-pass.

As the water temperature gradually increases, the bottom valve (2) opens wider, while the top valve (1) begins to close.

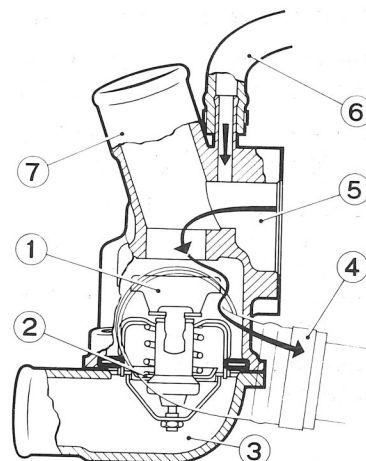
When the correct running temperature is reached, the top valve (1) will be fully closed, so that all the water sent to the engine cooling circuit will pass through the bottom valve (2).

The system is thus designed to enable hot water to be gradually mixed with cold so that the correct engine running temperature is reached as quickly as possible.

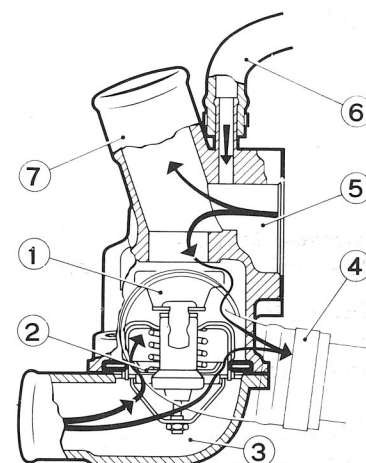
Thermostat opening is governed by the temperature of the water in the radiator as well as by that of the water returning from the engine.

When the cooling system is filled with water, a small quantity of air will inevitably be trapped in the pipe (3) connecting the radiator and the union containing the thermostat. Allowance is made for this by adding an extra 3 to 5 fluid ounces (100 to 150 cm^3) of water to the expansion tank. This will be taken up by the system as soon as the bottom thermostat valve opens.

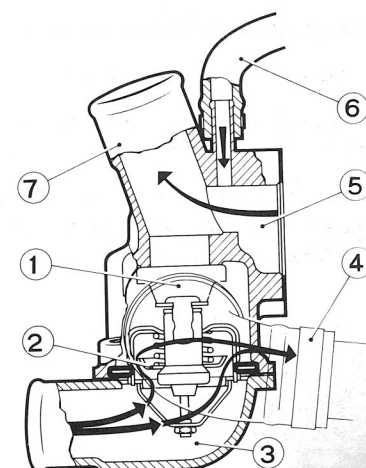
CLOSED



PARTLY OPEN



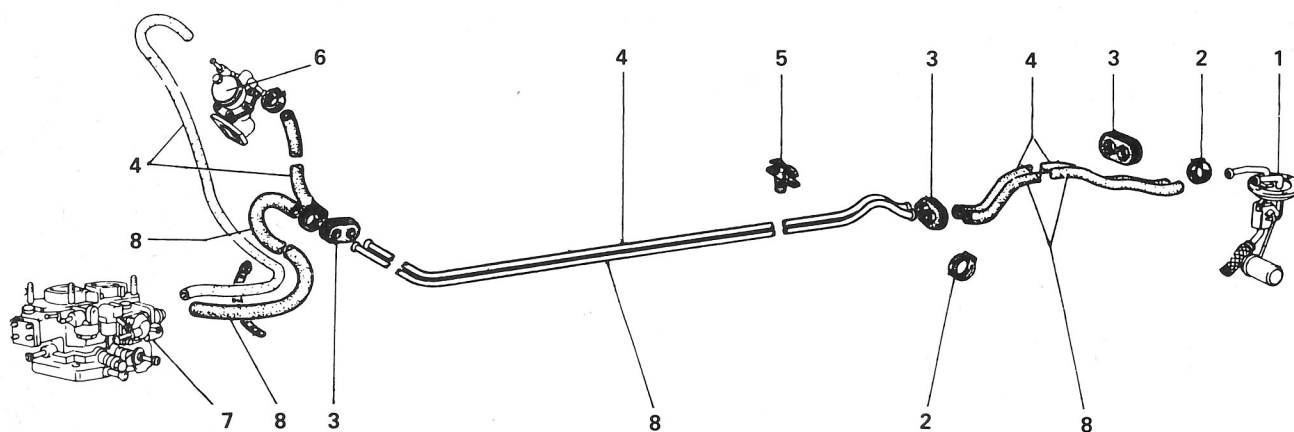
FULLY OPEN



1. Top valve of thermostat
2. Bottom valve of thermostat
3. Lower hose connection
4. Pump intake pipe connection
5. Water exit from cylinder head
6. Carburetor mixture preheating water return pipe
7. Upper hose connection

FUEL SYSTEM AND CARBURETOR

FUEL LINES



1. Fuel tank sender, pickup and return
2. Clamp
3. Grommet
4. Fuel supply line

5. Spacer
6. Fuel pump
7. Carburetor
8. Fuel return line

FUEL TANK

Removal and Installation

Remove fuel from tank by siphoning.

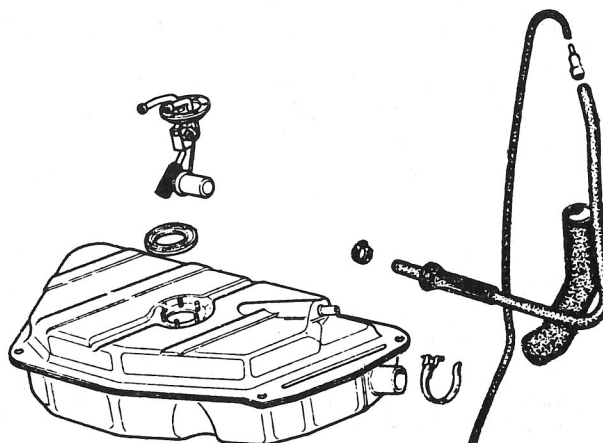
Disconnect filler line at tank.

At sending unit on top of tank, disconnect two electrical connectors and two fuel lines.

Remove four nuts and lockwashers holding tank to body. Lower tank until access to vapor and overflow lines is gained.

Disconnect lines and remove tank.

Installation is reverse of removal.



SENDING UNIT

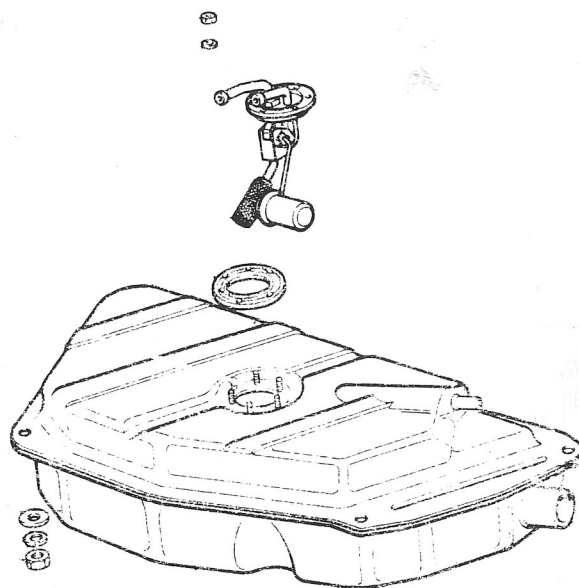
Removal and Installation

Open hatchback and remove floor covering.
Remove oval plastic access cover.

Disconnect two electrical connectors and two fuel lines.

Remove six nuts holding sending unit to tank and carefully remove sending unit.

Replace gasket during installation.

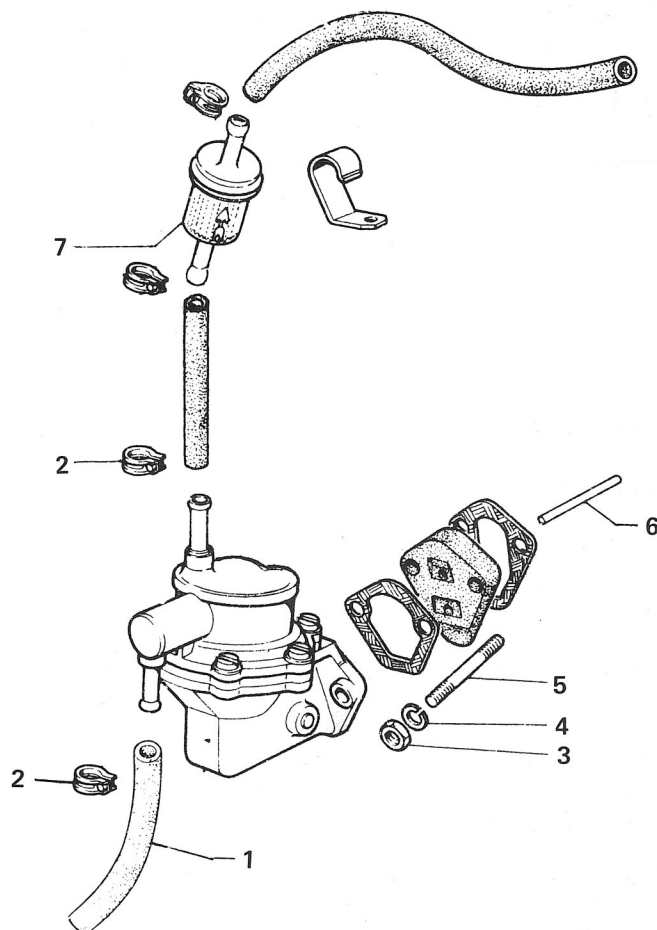


FUEL PUMP

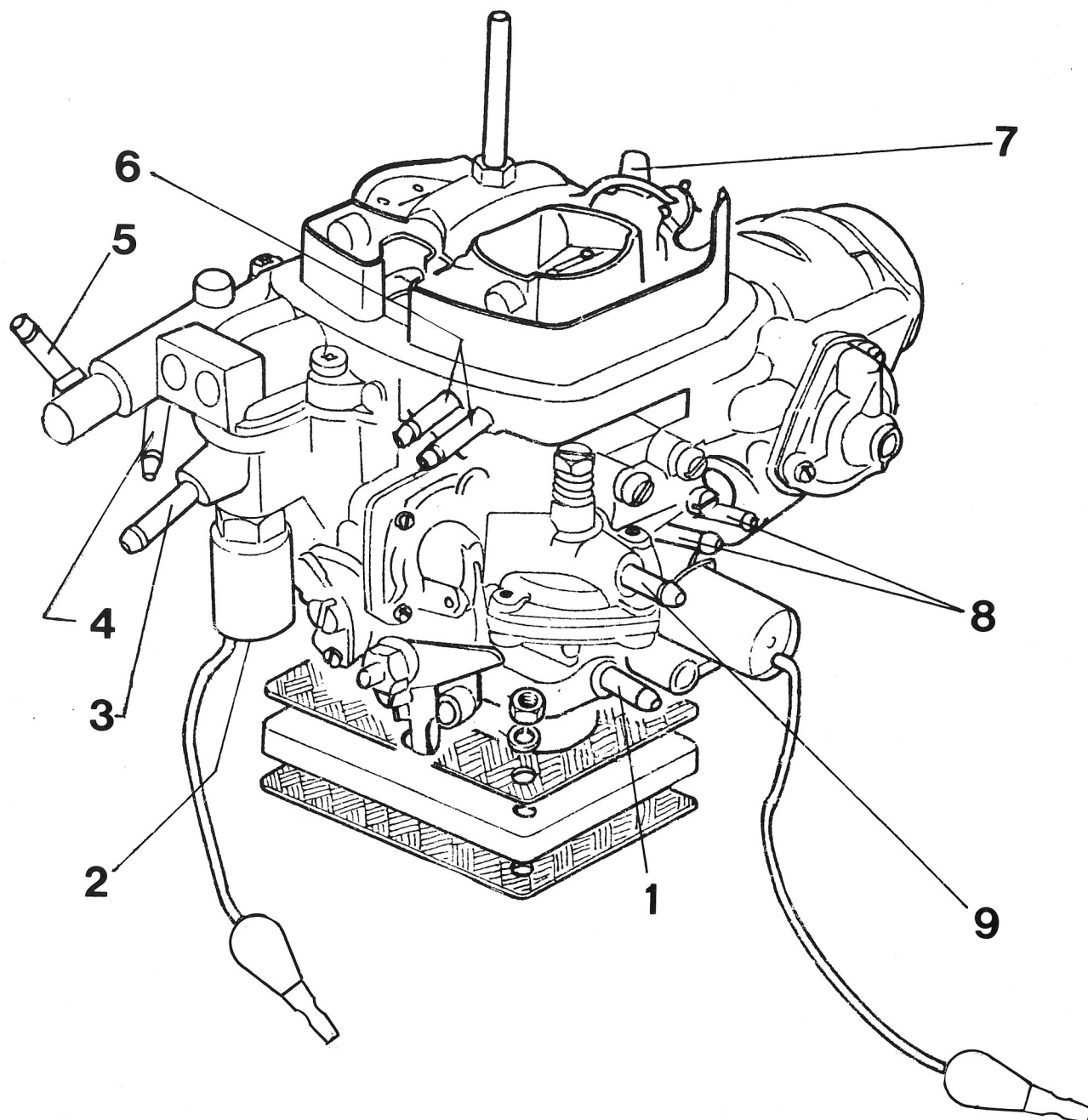
Removal and Installation

Loosen clamps (2) and disconnect fuel lines from pump. Leave filter (7) and fuel lines attached to vehicle.

Remove two nuts (3) and washers (4) from studs (5) holding the pump to the engine. Carefully remove the pump from the engine, make sure that the actuating rod (6) is removed.



CARBURETOR



1. Canister purge line
2. Float bowl vent solenoid
3. Float bowl vent line
4. Fuel return
5. Fuel supply
6. High altitude compensator
7. High altitude compensator connection
8. 4-port vacuum valve
9. 3-port vacuum valve

GENERAL DISCUSSION OF EMISSIONS

There are three types of emissions from the automobile: crankcase vapors, raw fuel vapors, and exhaust gases.

Crankcase Vapors

Crankcase vapors are fuel and exhaust gases which escape from the combustion chamber past the piston ring as blow-by and collect in the engine crankcase, plus a certain amount of diluted and vaporized engine oil. The release of these vapors is prevented by the crankcase emission control system.

Raw Fuel Vapors

These vapors occur in the fuel tank and carburetor, since gasoline evaporates easily. The release of these raw fuel vapors to the atmosphere is prevented by the evaporative emission system, including a fuel recirculation system.

Exhaust Gases

These include all of the used fuel charge after each

power stroke in a cylinder, and any by-products created during the combustion process.

Exhaust emissions are composed of three gases: Hydrocarbons (HC), essentially unburned fuel.

Carbon Monoxide (CO), an invisible, odorless gas caused by overly rich fuel/air mixtures.

Oxides of Nitrogen (NOx), compounds formed by the high temperatures and pressures in the combustion process.

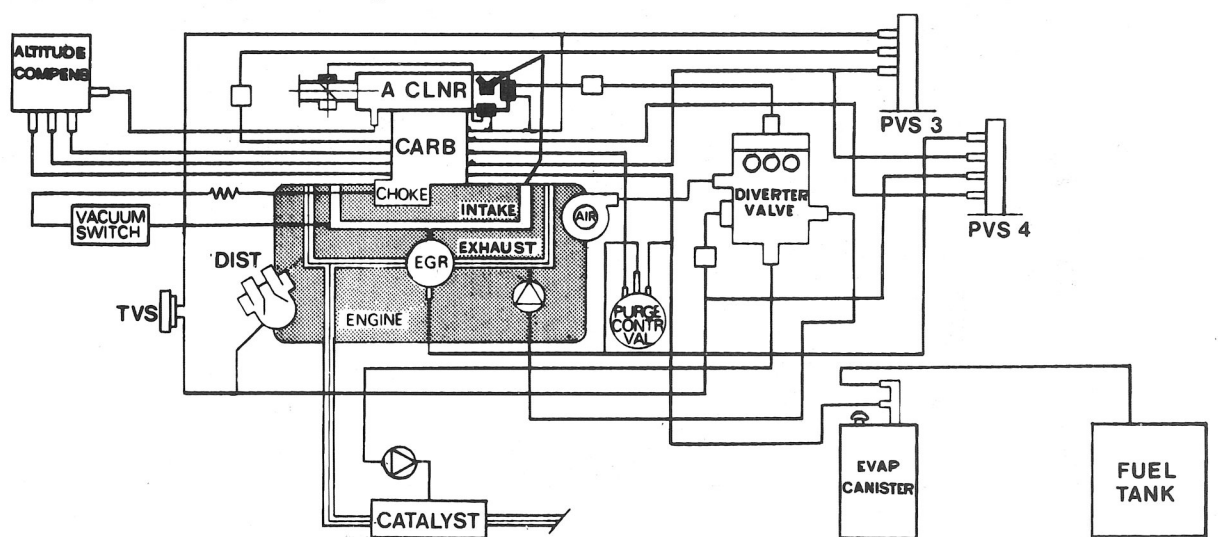
The efficiency with which the engine uses its fuel supply will have a great effect on exhaust gas quality. In addition, extra processing of the exhaust gases before they reach the atmosphere can reduce pollutants to lower levels.

The systems explained here are the following:

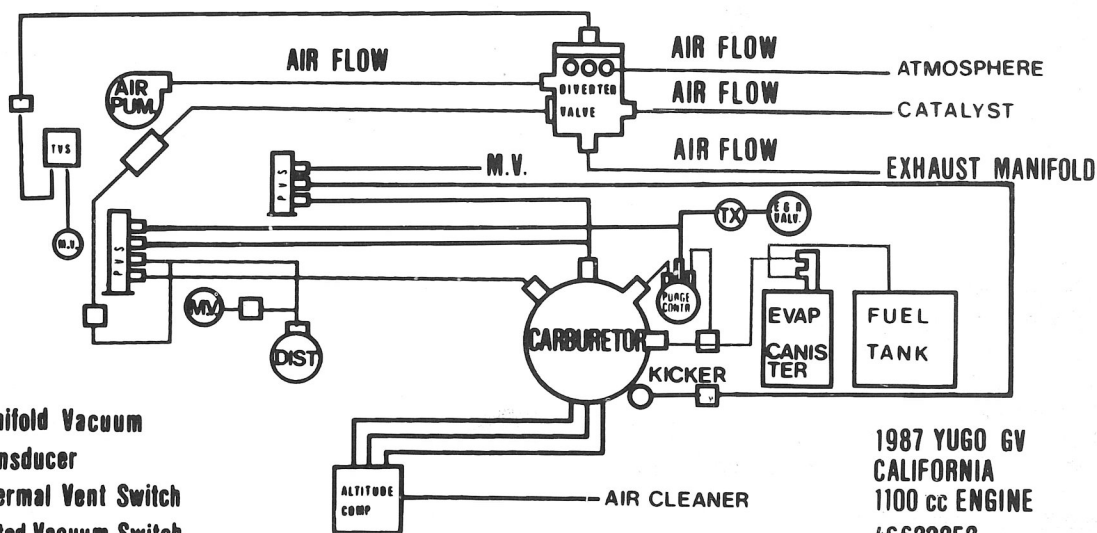
Crankcase Emission Control

Evaporative Emission Control

Exhaust Emission Control.



46622976



MV= Manifold Vacuum
TX = Transducer
TVS= Thermal Vent Switch
PVS=Ported Vacuum Switch

1987 YUGO GV
CALIFORNIA
1100 cc ENGINE
46623252

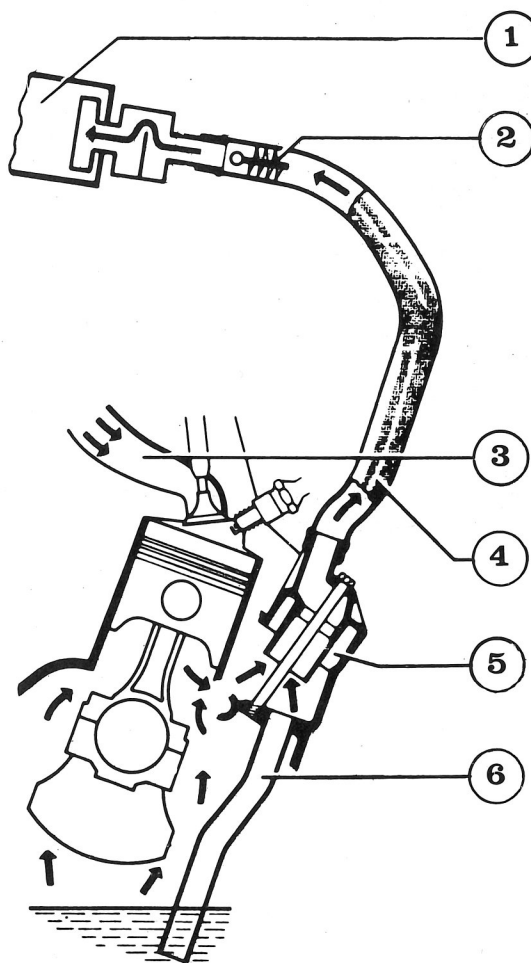
CRANKCASE EMISSION CONTROL SYSTEM

This is a closed crankcase ventilation system. The blow-by gases and vapors in the crankcase are recycled by being drawn into the combustion chambers and burned there rather than being vented to the atmosphere.

As the vapors leave the crankcase, they pass through a cyclonic trap. This device separates liquid oil from the vapors and returns the oil to the sump. The vapors then enter a hose connecting the trap to the air cleaner. A flame trap in the hose prevents the vapors in the crankcase from being ignited in case of carburetor backfire.

Another baffle at the air cleaner disperses the vapors as they enter. The vapors become part of the intake charge, entering through the carburetor and intake manifold into the combustion chambers.

1. Air cleaner
2. Flame trap
3. Intake port
4. Hose
5. Cyclonic trap
6. Oil return line



INTAKE AIR

Description

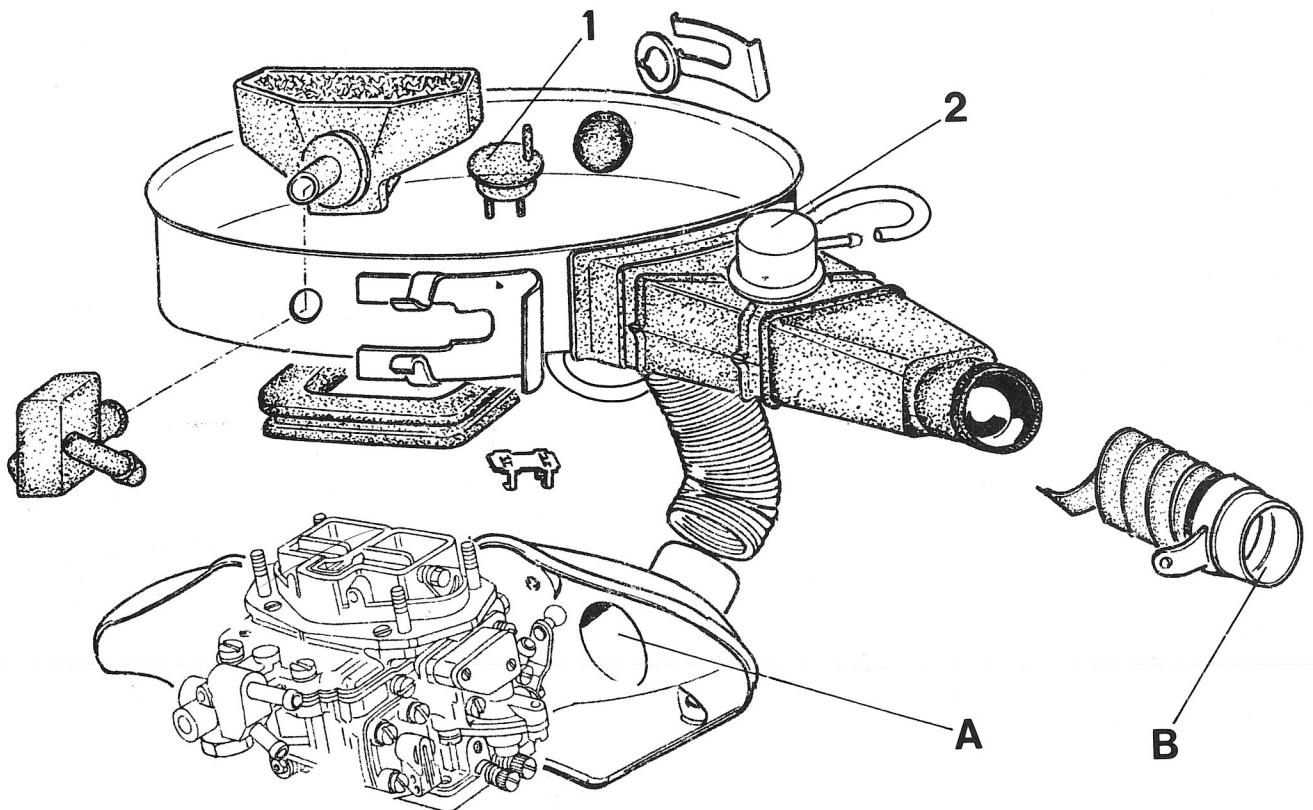
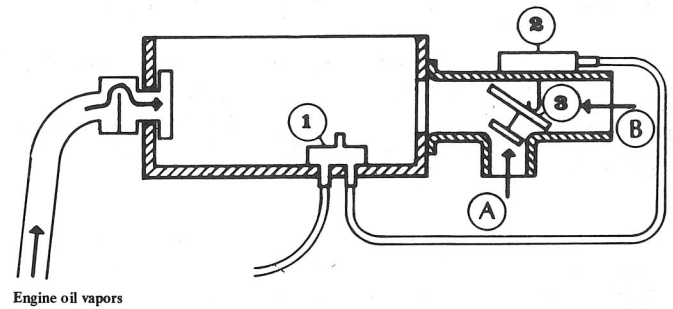
A thermostatically controlled air cleaner blends the intake air according to engine and ambient temperature.

Environmental air - cold:

Temperature switch (1) activates the vacuum motor (2) which opens the flap (3) and warm air enters through the opening (A).

Environmental air - warm

Temperature switch (1) does not activate the vacuum motor (2). The flap (3) is closed and ambient air enters through the opening (B).



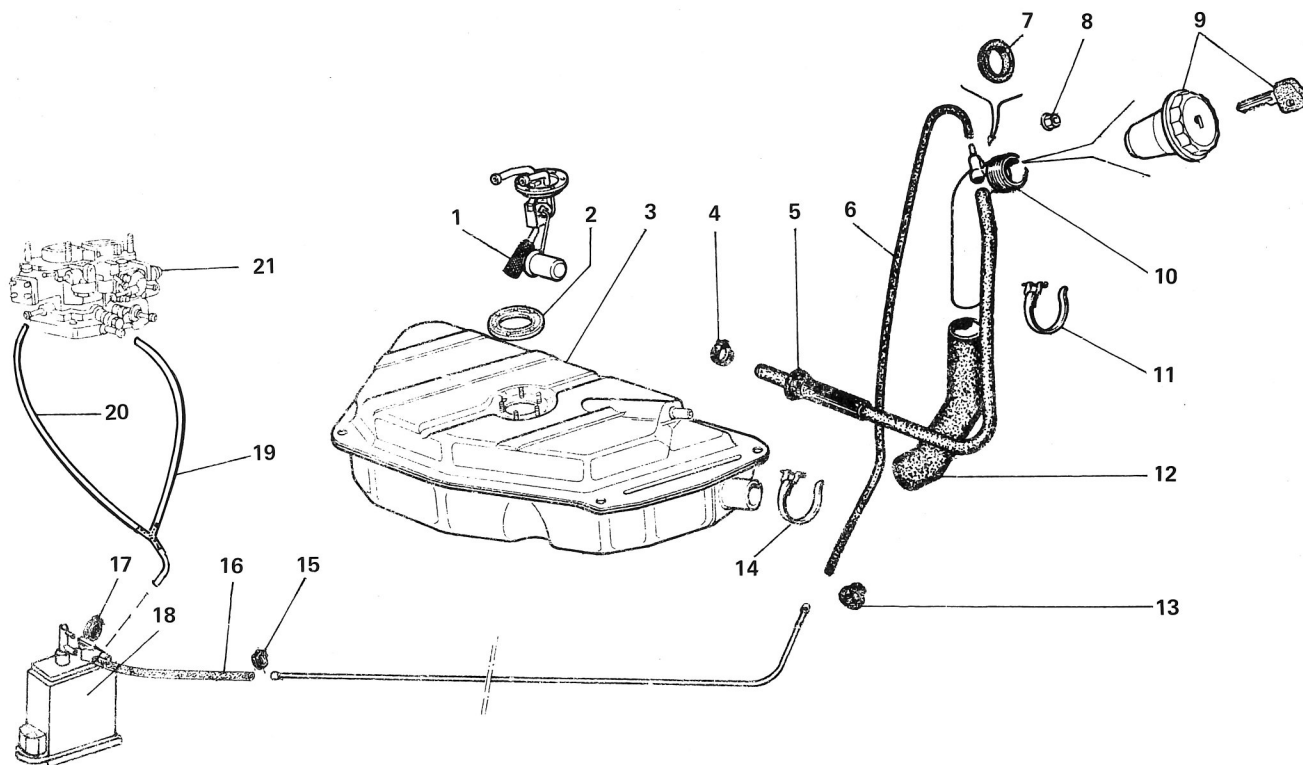
- 1. Temperature switch
- 2. Vacuum motor

- A. Warm air intake
- B. Cool air intake

EVAPORATIVE EMISSION CONTROL SYSTEM

This system prevents gasoline vapors from escaping into the atmosphere. It collects vapors from the fuel tank and carburetor float bowl, and stores them in a charcoal trap.

Vacuum is applied to the trap when the engine is running. This draws the vapors from the trap into the engine. They become a part of the intake charge, and are burned in the combustion chambers.

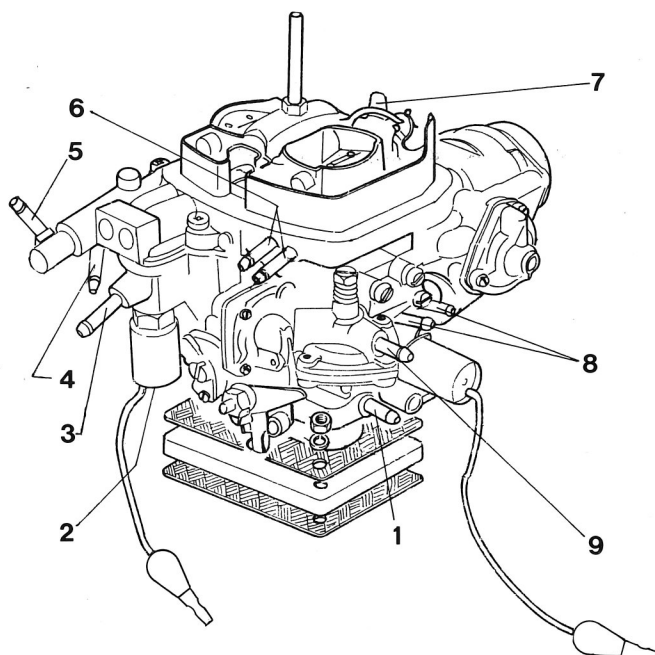


1. Sender
2. Sender gasket
3. Fuel tank
4. Clamp
5. Seal
6. Vent hose
7. Filler neck seal

8. Nut
9. Filler cap
10. Filler neck
11. Strap
12. Hose
13. Gasket
14. Strap

15. Clamp
16. Hose
17. Clamp
18. Canister
19. Float bowl vent line
20. Purge line
21. Carburetor

1. Canister purge line
2. Float bowl vent solenoid
3. Float bowl vent line
4. Fuel return
5. Fuel supply
6. High altitude compensator
7. High altitude compensator connection
8. 4-port vacuum valve
9. 3-port vacuum valve

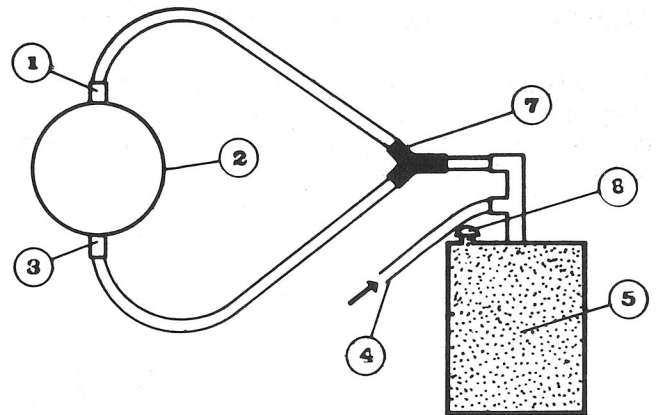


Operation

When the engine is off the float bowl vent valve opens. The fuel vapors from the carburetor and the fuel tank collect in the canister.

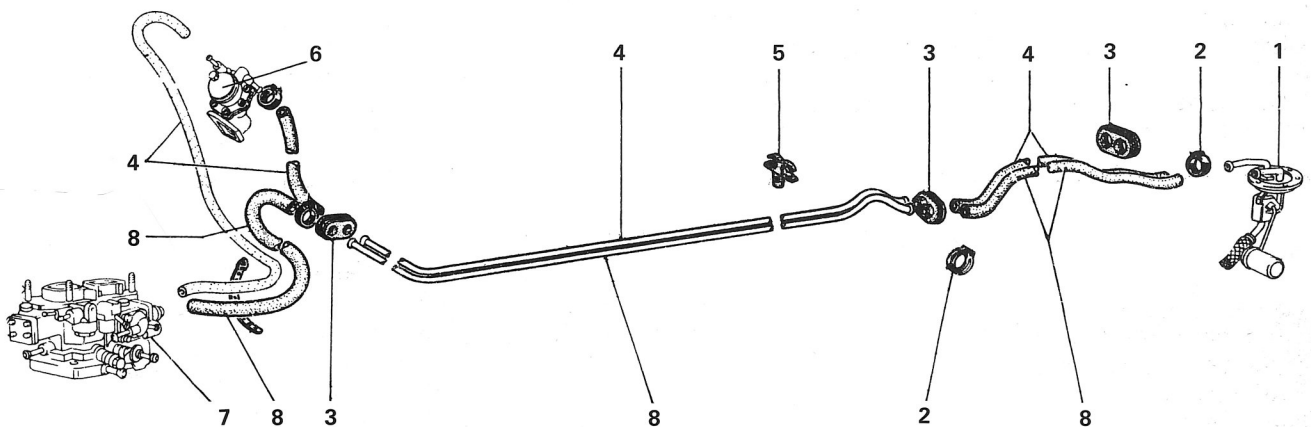
When the engine is running, the float bowl vent valve (3) closes. Engine vacuum is applied to the canister. This draws ambient air through the purge valve, canister, and canister purge line to the carburetor.

1. Canister purge port
2. Carburetor
3. Float bowl vent valve
4. Vapor line from fuel tank
5. Canister
6. Purge valve
7. T-connection



Fuel Recirculation

A fuel recirculation system prevents the fuel in the lines from absorbing heat from the engine compartment. This minimizes the possibility of fuel vaporization.



1. Fuel tank sender, pickup and return
2. Clamp
3. Grommet
4. Fuel supply line

5. Spacer
6. Fuel pump
7. Carburetor
8. Fuel return line

SECONDARY AIR SYSTEM (AIR INJECTION)

Description

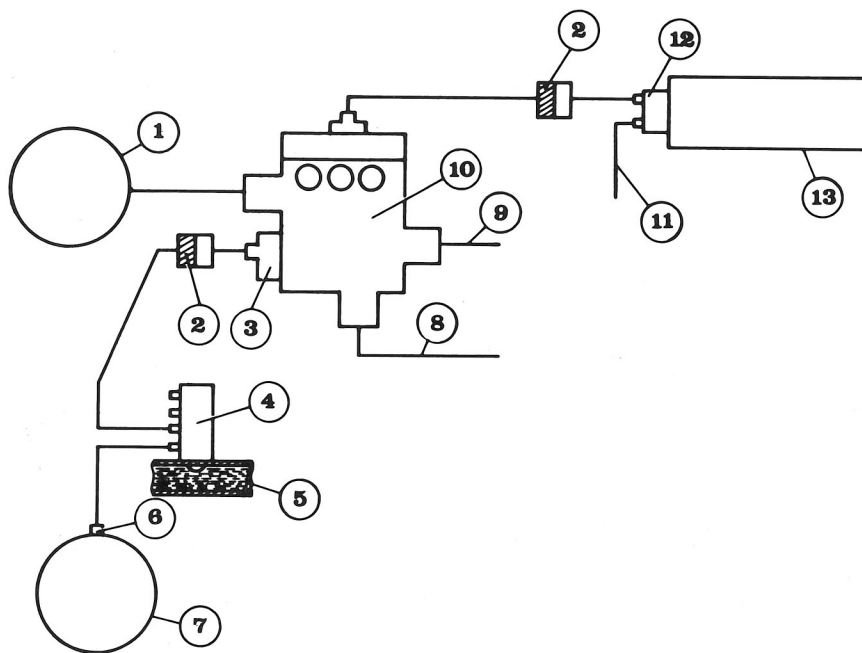
This system supplies fresh air through injectors mounted just downstream of each exhaust valve. The fresh air mixes with the exhaust charge as it leaves the combustion chamber. An unburned portion of the exhaust charge will unite with the oxygen in the injected air and be consumed in the exhaust manifold before the charge is released, through the exhaust system, into the atmosphere. The pump is driven at 70% of engine speed by a V belt from the water pump pulley. Belt tension adjustment is provided by the air pump upper mount bolt.

The pump uses rotating vanes on the pulley as a centrifugal filter. The Pressure Relief Valve, which opens when the supply of air from the pump becomes excessive, is in the Diverter Valve.

A Check Valve is mounted in the air supply line to prevent exhaust gasses from entering the diverter valve and air pump in case exhaust pressure becomes excessive.

All pump output is delivered through the output hose to the diverter valve, which controls the flow of fresh air to the injection manifold and the catalytic converter.

The primary function of the Diverter Valve is to shut off the supply of oxygen to the injectors during engine deceleration in order to prevent backfiring in the exhaust system. A Vacuum Signal from the intake manifold operates the diverter valve, and on deceleration will divert the pump output for about four seconds, through an exhaust orifice, to the atmosphere.



- | | |
|---------------------------|----------------------------------|
| 1. Air pump | 8. Output to catalytic converter |
| 2. Kicker 5CF | 9. Output to exhaust manifold |
| 3. Output switching valve | 10. Diverter valve |
| 4. 4-port vacuum valve | 11. Intake manifold vacuum |
| 5. Coolant | 12. Temperature vacuum switch |
| 6. Ported vacuum | 13. Air filter |
| 7. Carburetor | |

Operation

Engine cold: Pump output goes to the diverter valve. There is no vacuum signal applied to either diaphragm of the diverter valve. At idle and part throttle, pump output is directed through the diverter upper outlet, through the check valve and into the exhaust manifold. At wide open throttle, air will vent to the atmosphere in this mode.

Engine warm: With coolant temperature above 128°F., the 4-port temperature vacuum valve opens. Vacuum from above the throttle plate in the carburetor is applied through the TVS and a kicker to the diverter. Manifold vacuum is also applied through a temperature vacuum switch in the air cleaner at ambient temperature above 60°F. Pump output is channeled to the exhaust manifold at idle, to the catalytic converter at part throttle, and vented to the atmosphere at wide open throttle.

AIR PUMP

The air injection pump is a positive displacement vane type which is permanently lubricated and requires no periodic maintenance.

Intake air passes through a centrifugal filter fan at the front of the pump, where foreign materials are separated from the air by centrifugal force. Air is delivered to the air injection manifold through a flexible hose fitted to the exhaust tube on the diverter valve. Hoses are secured to all fittings by clamps.

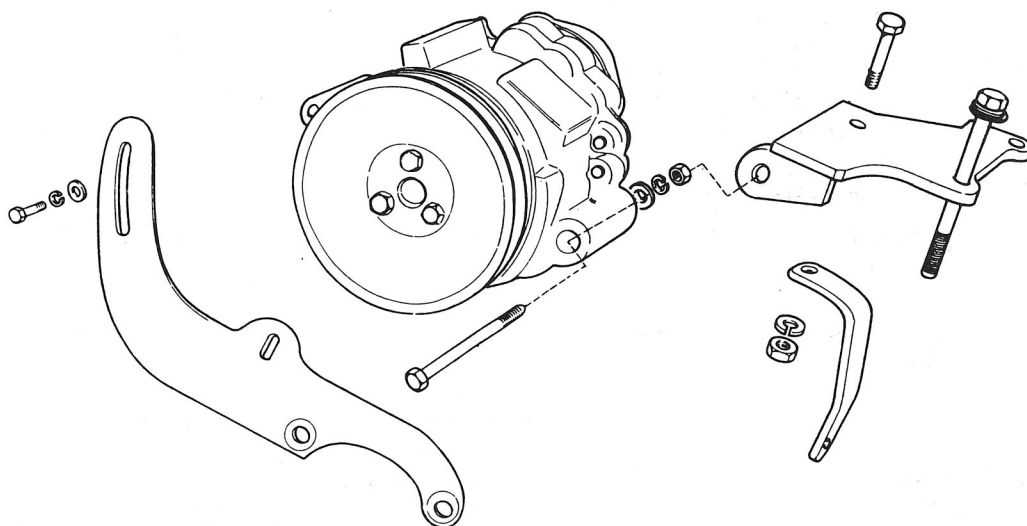
Note: The only serviceable component on all pumps is the centrifugal filter fan. Do not assume pump is defective if it squeaks when turned by hand. Do not lubricate the pump in any way.

Caution: Do not attempt to operate vehicle with drive belt disconnected.

Caution: If the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the centrifugal filter fan and vent holes should be masked off to prevent liquids from entering the pump.

Caution: Handle the pump carefully. Do not pry against the housing to gain belt tension. Do not hammer on any part of the housing. Do not put any part of the pump in a vise.

Caution: Do not attempt to correct rough idle or driveability problems by replacing the air pump.



Adjusting the pump

Loosen the lock bolt and drive belt tension by swinging the pump on its mount bolt. When properly tensioned, the belt will have about 1/2 inch deflection under moderate thumb pressure.

Note: Do not run the engine with the pump air delivery hose disconnected, as damage to the check valve may result.

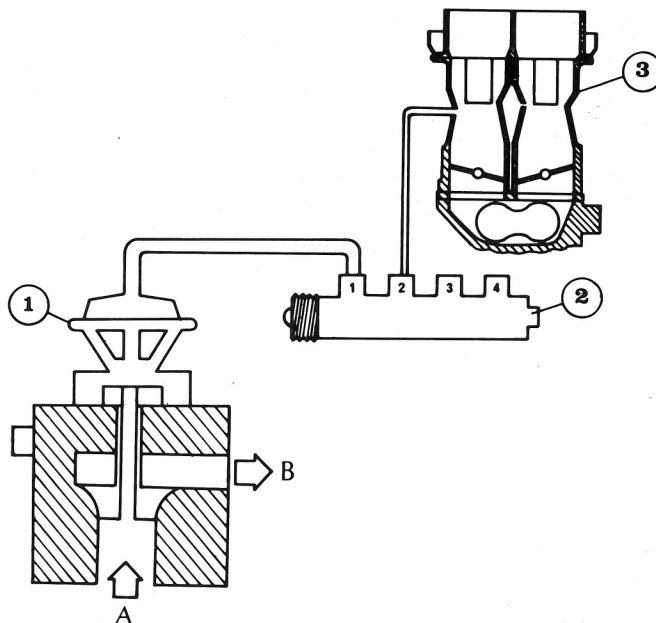
EXHAUST GAS RECIRCULATION (EGR)

Description

The EGR system helps to lower the peak burning temperatures and pressures in the combustion chambers, limiting the formation of Oxides of Nitrogen (NOx). This is accomplished by drawing a portion of the exhaust gases into the intake manifold under certain engine operating conditions. These gases mix with and dilute the incoming air/fuel mixture charge which results in lower temperatures and pressures.

By substituting 10 to 15% of the intake charge with exhaust gases a reduction of 50 to 60% of NOx can be obtained.

- A. Exhaust gas
- B. Intake manifold
- 1. EGR valve
- 2. 4-port temperature vacuum level
- 3. Carburetor



Operation

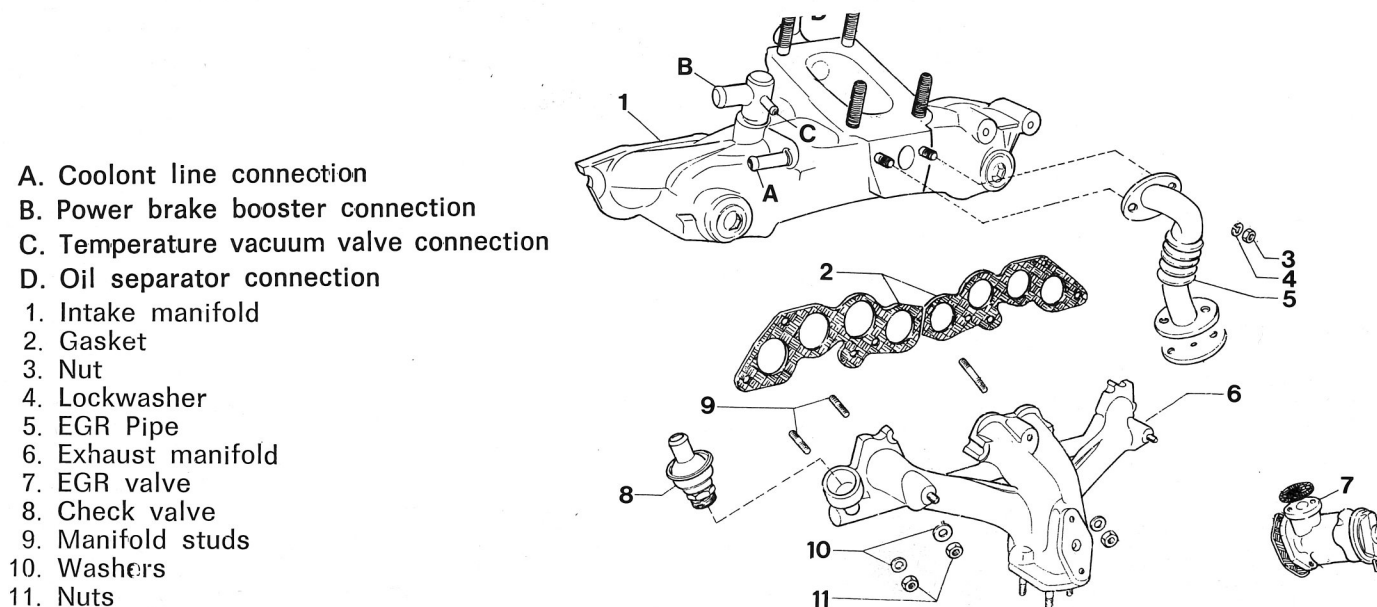
Exhaust gases are picked up from the exhaust manifold. An EGR valve is placed in the circuit between the exhaust and intake manifolds to control the flow of exhaust gas. The valve is actuated by a ported vacuum signal. The vacuum signal is taken from a port above the throttle plate in the carburetor. The vacuum signal line is interrupted by a temperature vacuum valve which senses engine coolant temperature.

Cold Engine

With the engine cold the temperature vacuum valve is closed. This blocks the vacuum signal to the EGR valve. The EGR valve remains closed preventing recirculation of exhaust gases. Thus, the intake charge is not diluted during cold engine operation.

Warm Engine

With the engine warm the valve is opened. This applies a vacuum signal to the EGR valve. This signal will cause the EGR valve to open, allowing recirculation of exhaust gases.



CATALYTIC CONVERTER — To further reduce HC and CO emissions the Catalytic Converter is placed in the exhaust system. It is a muffler-like can; all exhaust gases pass through it. The converter contains two beds. The surface area of these beds provides several hundred square yards of exposure to the exhaust gases.

The beds are coated with platinum and palladium, which cause chemical reactions in the toxic elements of the exhaust gases; CO is converted to CO₂ (carbon dioxide), and HC is converted to CO₂ (carbon dioxide) and H₂O (water). These chemical conversions occur at temperatures between 600° and 1200°F.

The catalytic material can be »poisoned« by lead and phosphorous additives in gasoline, destroying the ability of the converter to control emissions. To prevent this, use of Unleaded Fuel is required. Excessively rich mixtures can overheat and destroy the converter.

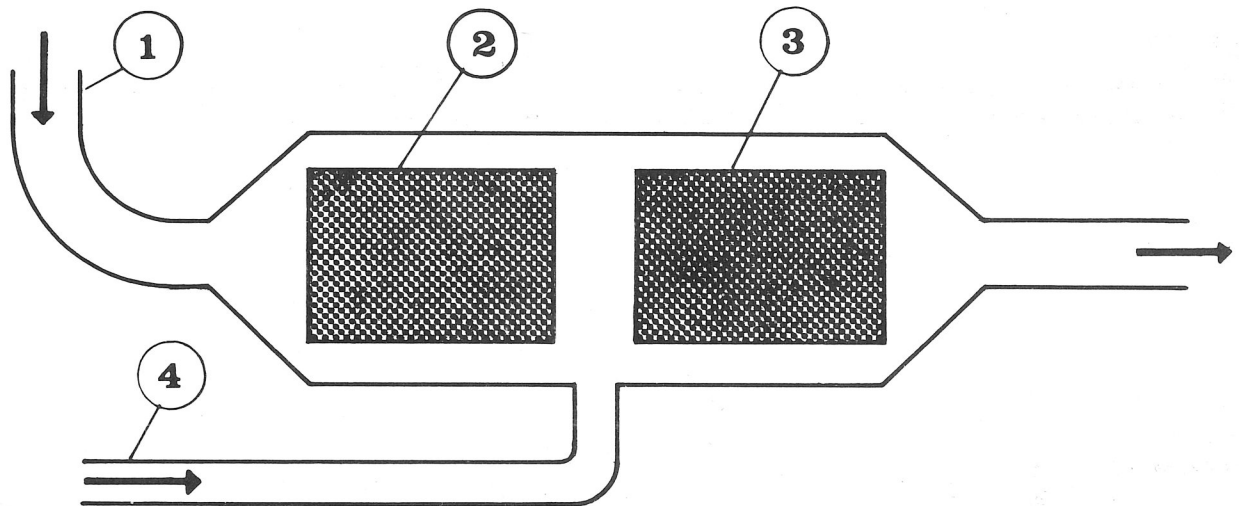
CATALYTIC CONVERTER

Engine cold:

Both ceramics in the catalytic converter perform oxidation when the air enters the catalytic converter from the manifold.

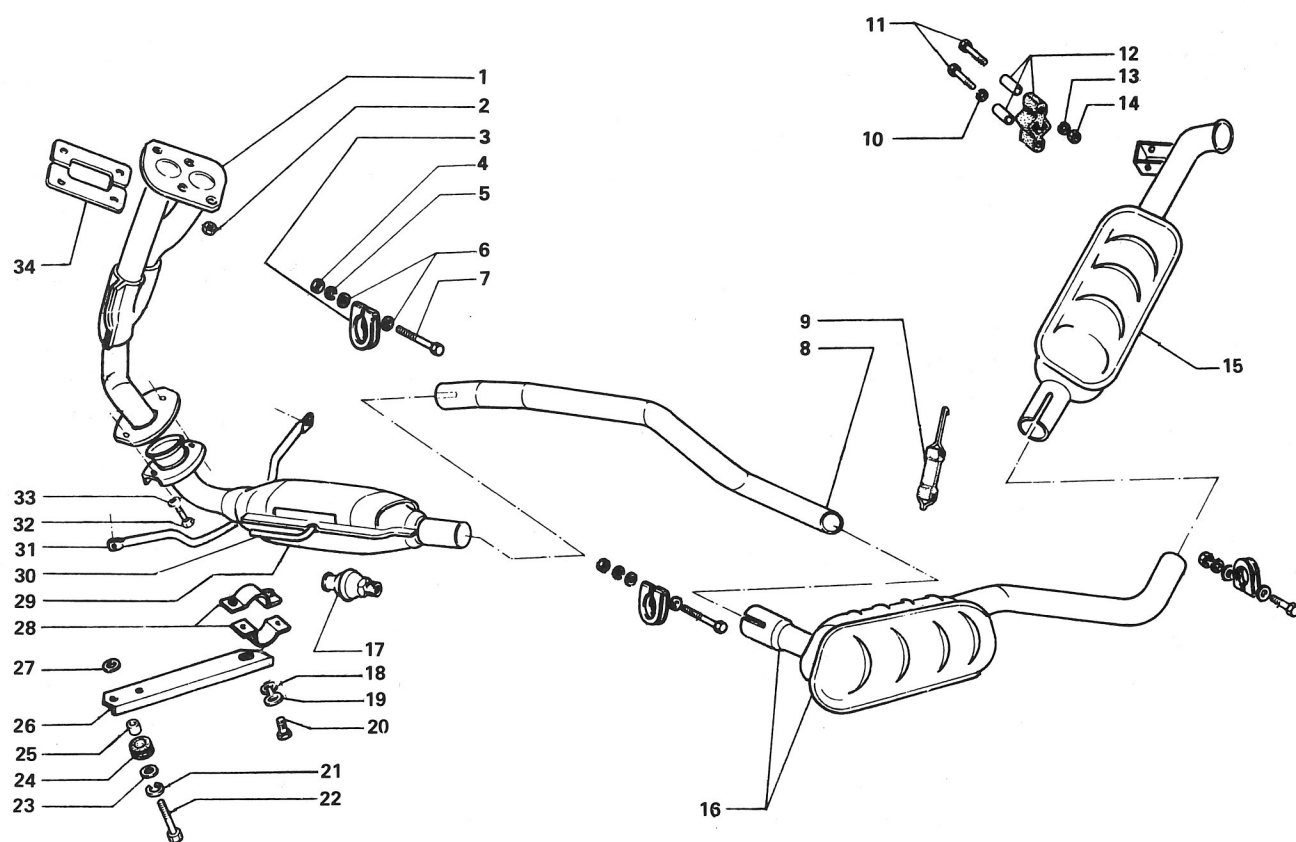
Engine warm:

The first ceramic performs reduction and the second ceramic performs oxidation since the air enters the converter through the diverter valve.



1. From exhaust manifold
2. Ceramic I (Oxidation + reduction)
3. Ceramic II (Reduction)
4. From diverter valve

Exhaust system



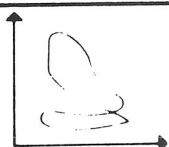

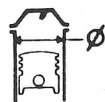
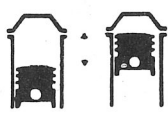
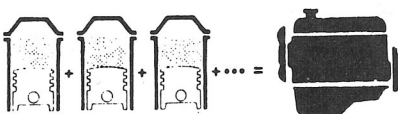
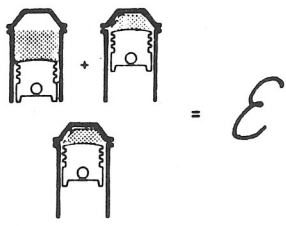
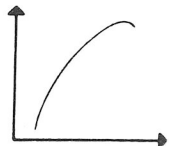

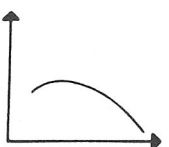
1. Exhaust pipe
2. Nut
3. Clamp
4. Nut
5. Lockwasher
6. Washer
7. Bolt
8. Exhaust pipe
9. Hanger

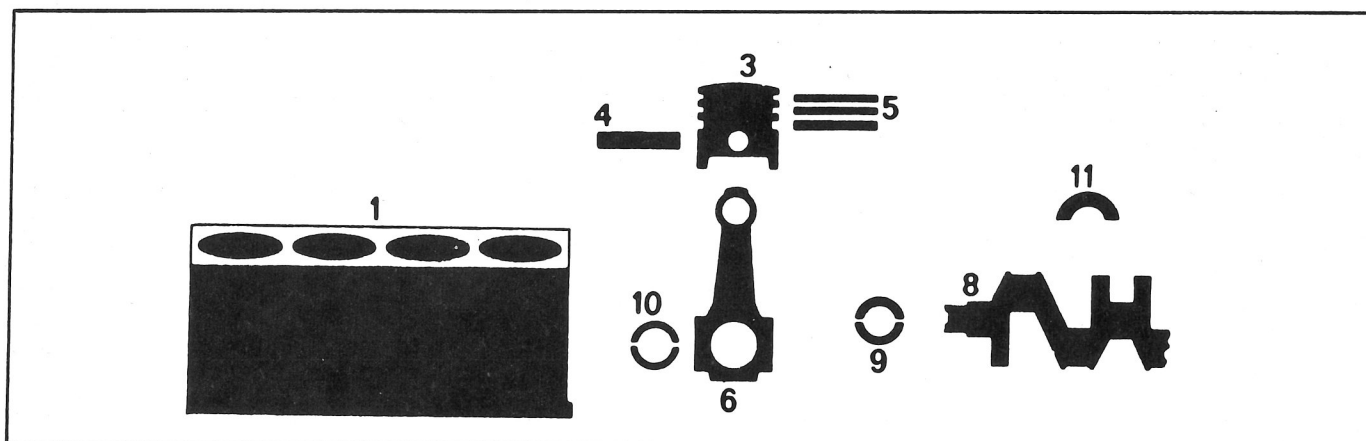
10. Lock washer
11. Bolt
12. Support
13. Lock washer
14. Nut
15. Resonator
16. Muffler
17. Check valve
18. Lock washer

19. Washer
20. Bolt
21. Lock washer
22. Bolt
23. Washer
24. Bushing
25. Spacer
26. Bracket
27. Washer



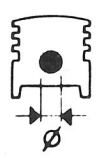







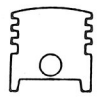
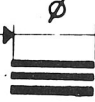





28. Clamp
29. Catalytic converter
30. Air supply tube
31. Guard
32. Bolt
33. Lock washer
34. Gasket

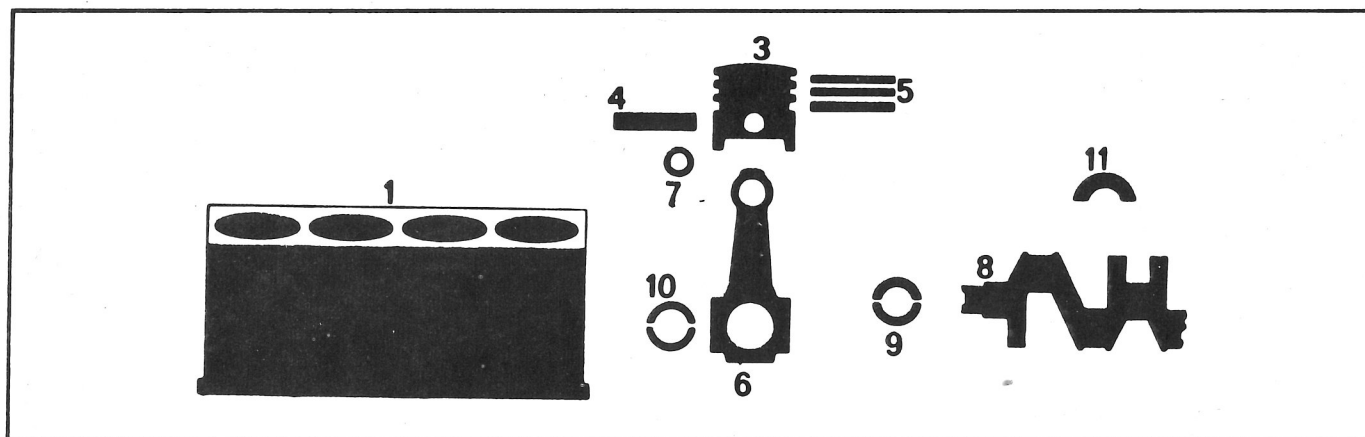
SPECIFICATIONS

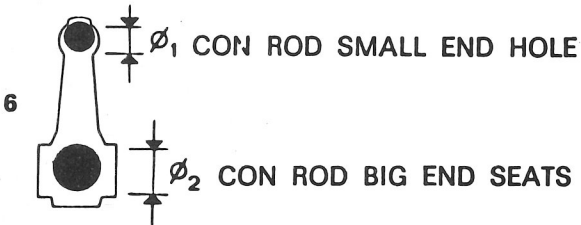
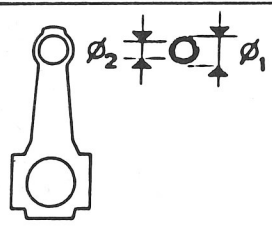


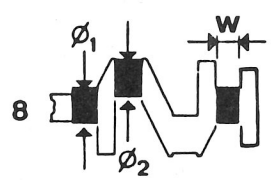
	CYCLE	OTTO FOUR STROKE	
	No. of CYLINDERS	4	
	BORE	3.401 in	86,4 mm
	STROKE	2.180 in	55,375 mm
	TOTAL CAPACITY	79.28 cu. in	1298,65 cm ³
	COMPRESSION RATIO	9,1	
  	MAX. OUTPUT DIN	60,3 HP	45 kW
		5000 min ⁻¹	
		64,73 Ft.Lb.	87,76 Nm
	MAX. TORQUE	3000 min ⁻¹	



<p>CYLINDER BLOCK</p>	w	in	mm
	ϕ	.8716 – .8740	22,140 – 22,200
<p>AUXILIARY SHAFT BUSHING SEATS</p>	ϕ_1	1.5236 – 1.5248	38,700 – 38,730
	ϕ_2	1.3794 – 1.3805	35,036 – 35,066
<p>CYLINDERS</p> <p>$\phi \left(\begin{array}{c} \text{trapezoid} \\ 0,010 \end{array} \right)$</p>		3.401 – 3.403	86,400 – 86,440
<p>PISTONS</p> <p>ϕ O/S</p>	Y	1.018	25,85
	A	3.3996 – 3.4003	86,351 – 86,369
	B	3.4000 – 3.4007	86,361 – 86,379
	C	3.4004 – 3.4011	86,371 – 86,389
	D	3.4008 – 3.4015	86,381 – 86,399
	E	3.4012 – 3.4019	86,391 – 86,409
		.008 – .016 – .024	0,2 – 0,4 – 0,6

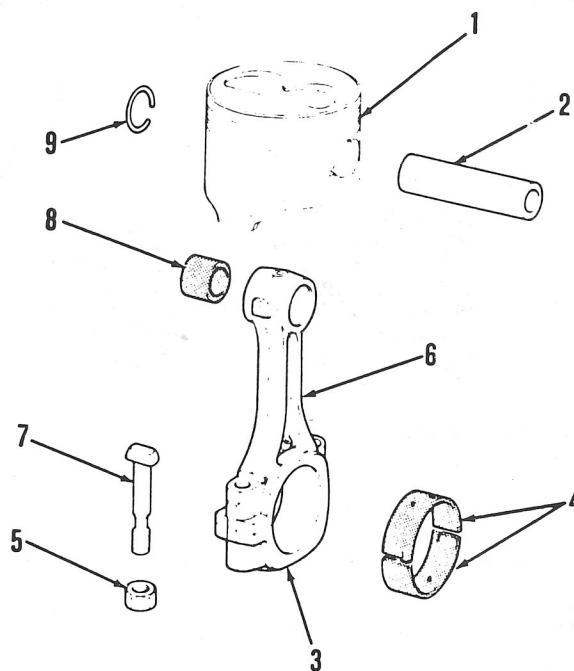
3	 PISTON WEIGHT DIFFERENCE	in	mm
		$\pm 0.176 \text{ oz.}$	$\pm 5 \text{ gr}$
3-1	 PISTON — CYLINDER	.00012 — .00193	0,031 — 0,049
3	 PISTON PIN SEAT ϕ 	.8659 — .8665	21,996 — 22,001
4	  ϕ 	.8657 — .8659	21,991 — 21,995
	PISTON PIN ϕ O/S	.0079	0,2
4-3	 PISTON PIN — PIN SEAT	.000039 — .00039	0,001 — 0,01
3	 PISTON GROOVES 	1 .0602 — .0610	1,53 — 1,55
		2 .0799 — .0807	2,03 — 2,05
		3 .1189 — .1197	3,02 — 3,04
5	  ϕ  L	1 .0582 — .0587	1,478 — 1,490
		2 .0778 — .0783	1,978 — 1,990
		3 .1134 — .1142	2,88 — 2,90
	PISTON RINGS ϕ O/S	.0079 — .0157 — .0236 —	0,2 — 0,4 — 0,6
5-3	 PISTON GROOVES — PISTON RINGS 	1 .00157 — .00283	0,040 — 0,072
		2 .00157 — .00283	0,040 — 0,072
		3 .00472 — .00629	0,12 — 0,16
5-1	 	1 .0118 — .0177	0,30 — 0,45
		2 .0118 — .0177	0,30 — 0,45
		3 .0079 — .0276	0,20 — 0,70
	PISTON RING GAP, FITTED IN CYLINDER. 3		



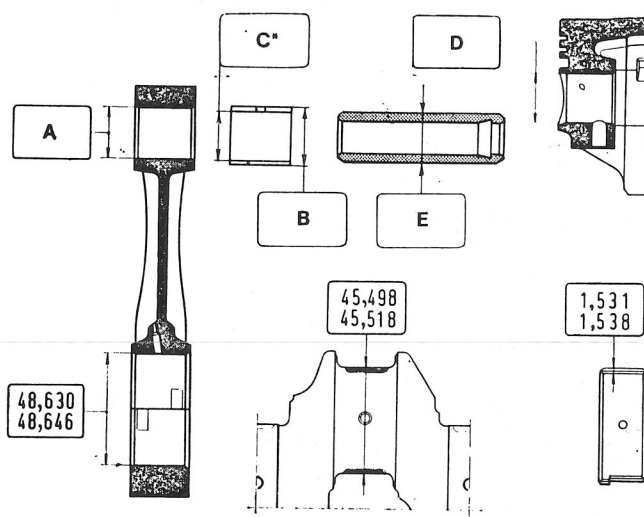
	in		mm	
	.9425 – .9438		23,939 – 23,972	
	ϕ_2 }	ϕ_1	.9455 – .9465	24,016 – 24,041
		1	.8677 – .8664	22,04 – 22,007
		2	.8664 – .8665	22,007 – 22,010
4-7 	.00047 – .00075		0,012 – 0,019	
7-6 	.00173 – .00402		0,044 – 0,102	
	MAIN BEARING JOURNAL ϕ_1		1.9994 – 2.0002	50,785 – 50,805
	ROD BEARING JOURNAL ϕ_2		1.7913 – 1.7920	45,498 – 45,518
	W		1.0620 – 1.0640	26,975 – 27,025

ROD-PIN-PISTON ASSEMBLY

1. Piston
2. Pin
3. Big-end cap
4. Bearings
5. Cap nut
6. Connecting rod shank
7. Cap bolt
8. Small-end bushing
9. Circlip



	in	mm
A =	.9425 – .9438	23,939 – 23,972
B =	.9455 – .9465	24,016 – 24,041
C ¹	.8677 – .8664	22,004 – 22,007
C ₂	.8664 – .8665	22,007 – 22,010
D =	.8659 – .8665	21,996 – 22,001
E =	.8657 – .8659	21,991 – 21,995

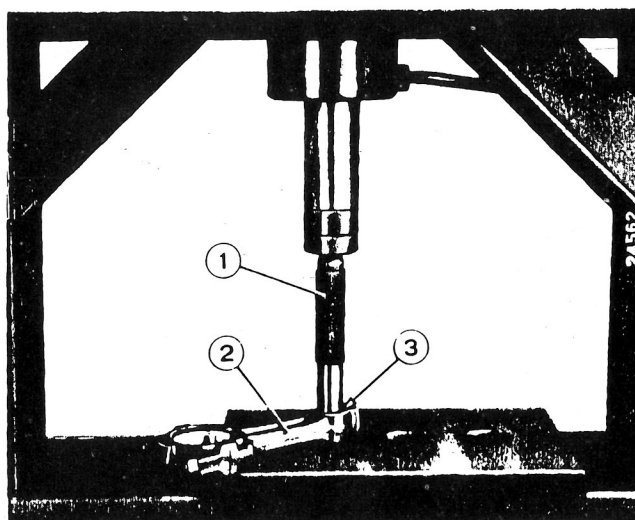


CONNECTING RODS

REMOVAL AND INSTALLATION SMALL-END BUSHING

Bushing is removed and installed on a suitable press with toll A.60054, as shown.

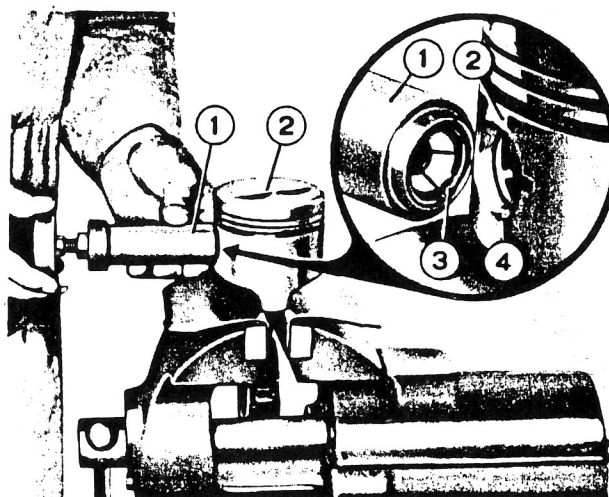
1. Drift A.60054
2. Connecting rod
3. Small-end bushing

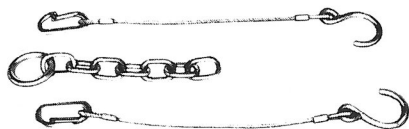


To fit piston pin circlips (3), use tool A.60303 (1) as shown.

After installation, ensure that circlip end gap is not in line with slot provided in piston, to make removal of circlip easier.

1. Tool A.60303
2. Piston
3. Circlip
4. Circlip groove in piston





A. 60592 YUGO GV/GVX

Lifting tackle for removing and refitting engine.



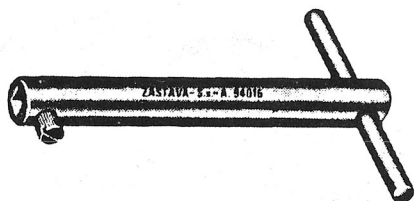
A. 61001/231 YUGO GV/GVX

Arm, engine fixing on rotating stand A.61000.



A. 61001/222 YUGO GV/GVX

Arm, engine fixing on rotating stand A.61000.



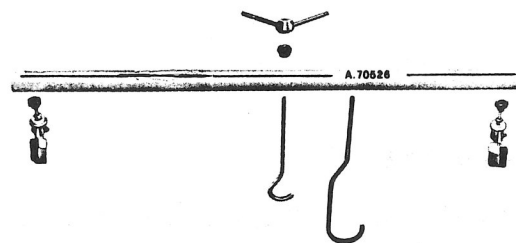
A. 94016 YUGO GV/GVX

Spindle, for the cutter used for the plug seats.



A. 94016/10 (Ø 10) YUGO GV/GVX

Cutter, crankshaft plug seat refacing (to be used with mandrel A.94016).



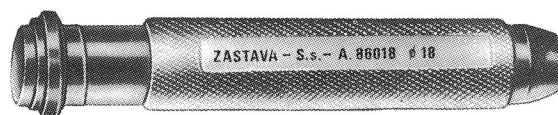
A. 70526 YUGO GV/GVX

Engine supporting bar used when replacing engine crossmember.



A. 86010 (Ø 10) YUGO GV/GVX

Drift rod, crankshaft welch plugs installation.



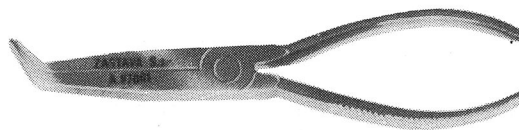
A. 86018 (Ø 18) YUGO GV/GVX

Striker, welch plug installation on camshaft rear end.



A. 60421 YUGO GV/GVX

Tool, holding tappets for replacing cup plates while adjusting tappets clearance.



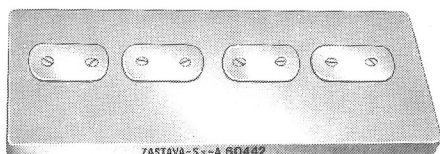
A. 87001 YUGO GV/GVX

Pliers, tappet plates removal.



A. 60462 YUGO GV/GVX

Drift for inserting valve guides.



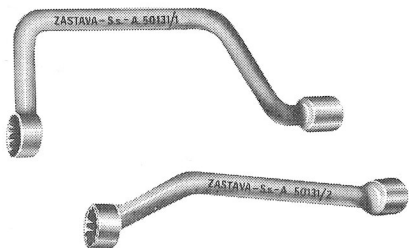
A. 60442 YUGO GV/GVX

Board, cylinder head support during valve removal and installation.



A. 50132 (13 mm) YUGO GV/GVX

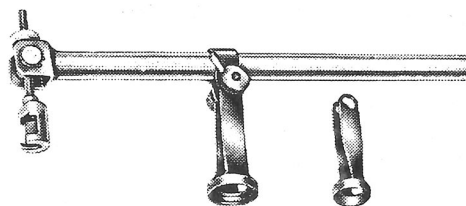
Wrench socket, 1/2" square, for engine cambox cover screws (to be used with torque wrench).



A. 50131 (19 mm) YUGO GV

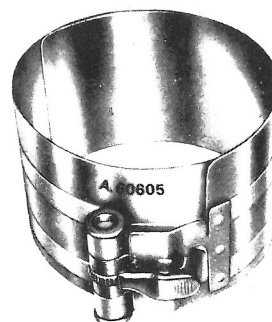
A. 50172 (17 mm) YUGO GV/GVX

Wrench sockets, 1/2" square, for carburetor end cylinder head holddown nuts (to be used with torque wrench).



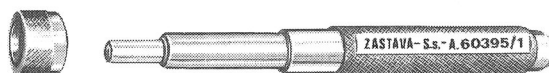
A. 60644 YUGO GV/GVX

Tool for removing and reassembling engine valves.



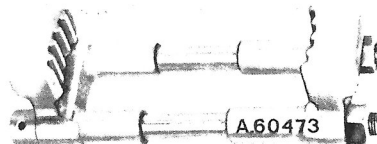
A. 60605 YUGO GV/GVX

Ring compressor for standard and oversize piston installation into cylinders.



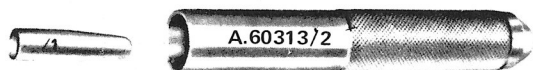
A. 60395 YUGO GV/GVX

Drift for removing valve guides.



A. 60473 YUGO GV/GVX

Tool, locking camshaft pulley while tightening or loosening retainer screw.



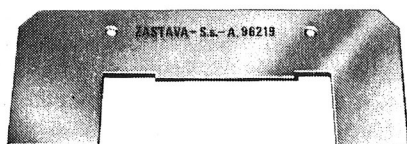
A. 60313 YUGO GV/GVX

Installer, oil seal on valve guide.



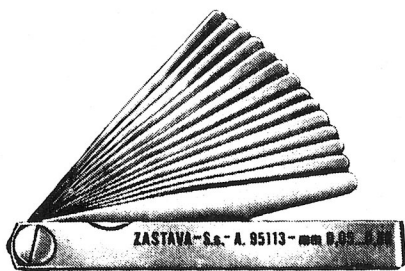
A. 90310 (Ø 8) YUGO GV/GVX

Cutter for valve guide ports.



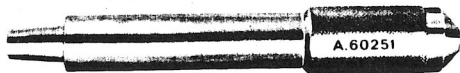
A. 96219 YUGO GV/GVX

Gauge, valve stem height check after valve seat refacing.



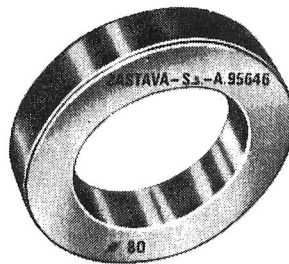
A. 95113 YUGO GV/GVX

Feeler gauge, for adjusting clearance between valve and rocker arms.



A. 60251 YUGO GVX

Tool, piston pin remover and installer.



A. 95646 (Ø 80) YUGO GV

A. 96148 (Ø 86) YUGO GVX

Master gauge, for setting cylinder bore checking dial indicator A.95687.



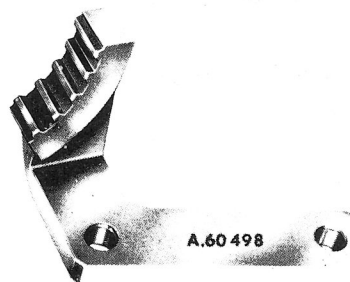
A. 60325 YUGO GV

Tool, hot fitting of pin in connecting rod and piston.



A. 60379 YUGO GV

Drift rod; for removal on press of piston pins (to use with support A.95615).



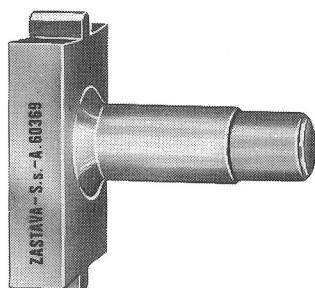
A. 60498 YUGO GV/GVX

Tool for locking auxiliary shaft sprocket.



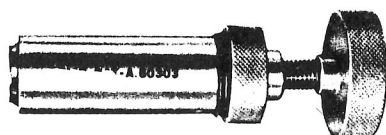
A. 90308 (Ø 22) YUGO GVX

Expansion reamer for connecting rod small end bushing.



A. 60369 YUGO GV/GVX

Tool, flywheel retainment during installation on crankshaft.



A. 60303 YUGO GVX

Installer, piston pin snap rings.



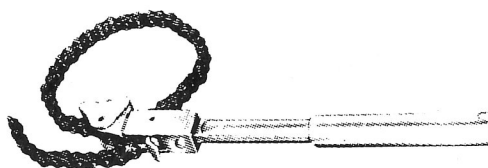
A. 60054 YUGO GVX

Tool for bush fitting into connecting rod rod small end.



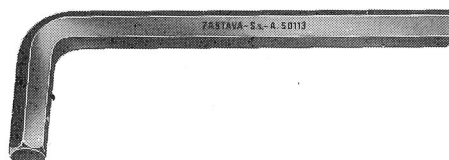
A. 50121 YUGO GV/GVX

Crankshaft pulley nut spanner.



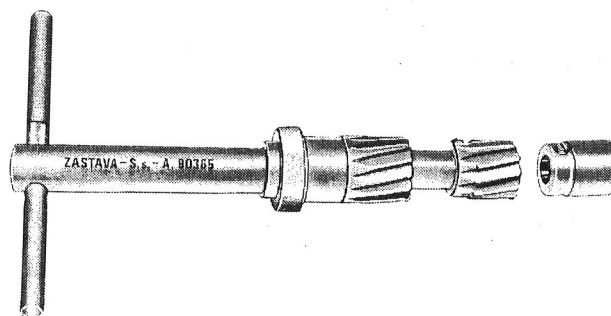
A. 60662 YUGO GV/GVX

Tool, cartridge oil filter removal.



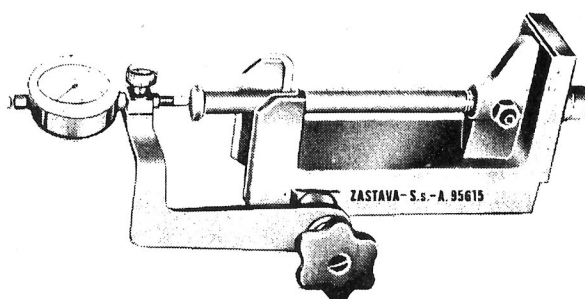
A. 50113 YUGO GV/GVX

Wrench for engine oil draining plug.



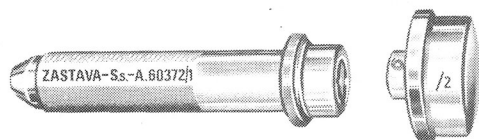
A. 90365 YUGO GV/GVX

Reamer for fuel pump, ignition distributor and oil pump drive shaft bushing.

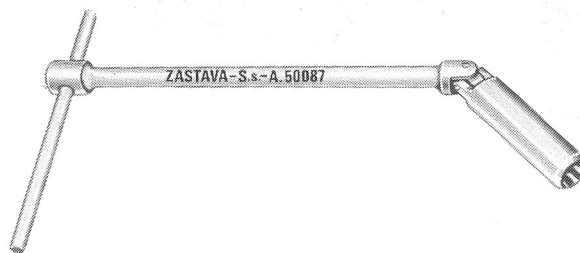


A. 95615 YUGO GV

Tool for checking rod-to-piston joint and support during removal.

**A. 60372 YUGO GV/GVX**

Installer and remover for fuel pump, ignition distributor and oil pump drive shaftbushing.

**A. 50087 YUGO GV/GVX**

Spark plug wrench.





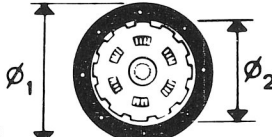

CLUTCH

CLUTCH

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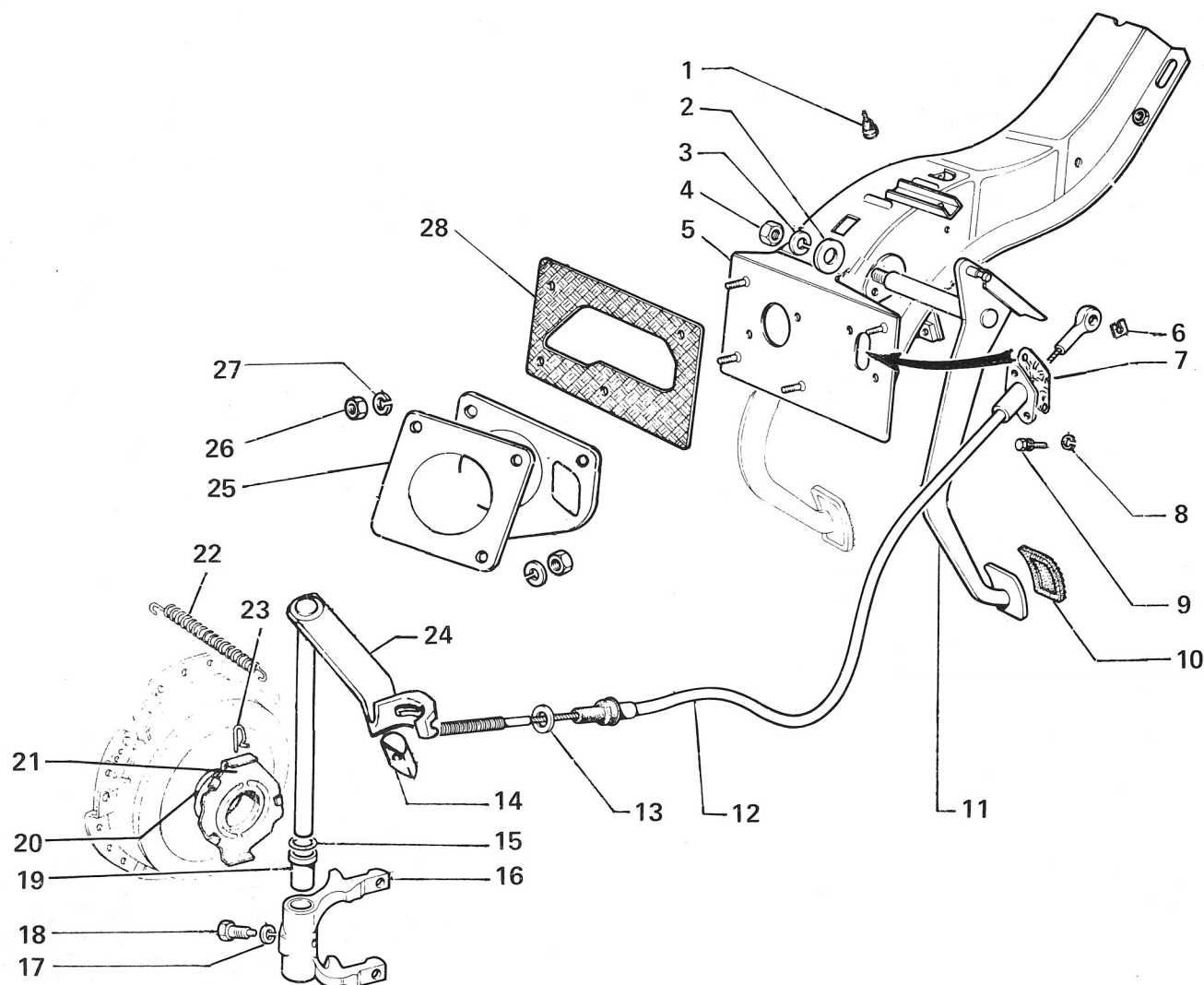
SPECIFICATIONS

CLUTCH

		in	mm
TYPE			
		DRY, SINGLE DISC	
			
ENGAGEMENT AND DISENGAGEMENT MECHANISM		DIAPHRAGM SPRING	
 CLUTCH DISC	ϕ_1	7.146	181,5
	ϕ_2	5.000	127
	CLUTCH PEDAL FREE TRAVEL	1.000	25
DIAPHRAGM SPRING STROKE CORRESPONDING TO MINIMUM DISC TRAVEL OF .067 in. 1,7 mm		.335 — .339	8,5 — 8,6
CLUTCH CONTROL		MECHANICAL	

TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Torque		
		Ft Lb	Kgm	Nm
Pressure plate bolt	M 6	12	1,6	15,7
Release fork bolt	M 8	19	2,6	25,5
Clutch pedal pivot shaft nut	M 8	11	1,5	14,7
Clutch and brake pedal bracket nut	M 8	11	1,5	14,7



- | | | |
|--------------------|------------------|----------------------|
| 1. Plug | 11. Clutch pedal | 20. Throwout bearing |
| 2. Washer | 12. Clutch cable | 21. Flange |
| 3. Lockwasher | 13. Ring | 22. Return spring |
| 4. Nut | 14. Nuts | 23. Spring clip |
| 5. Support bracket | 15. Seal | 24. Lever |
| 6. Clip | 16. Release fork | 25. Plate |
| 7. Gasket | 17. Lockwasher | 26. Nut |
| 8. Lockwasher | 18. Bolt | 27. Lockwasher |
| 9. Bolt | 19. Bushing | 28. Gasket |
| 10. Pad | | |

CABLE AND PEDAL REMOVAL

Remove clip (6) from the pin on clutch pedal (11). Remove the cable eyelet from the pin. In engine compartment, remove the spare tire. Remove nuts (14) holding cable (12) in lever (24). Remove threaded end of cable (12) from lever (24) and remove ring (13).

Remove two bolts (9) and remove cable (12).

To remove clutch pedal (11), remove nut (4), washer (3) and washer (2). Slide pedal shaft out of support bracket (5).

NOTE: The brake pedal uses the shaft on the clutch pedal as a pivot.

INSPECTION

Check that the cable moves freely inside the housing. Check that the threaded end is not damaged and that the eyelet end is not worn. Replace if damaged.

Check clutch pedal shaft and shaft bore for wear. Replace if worn. Check return spring tension. Replace if weak, cracked or broken.

INSTALLATION

Using white grease, lightly coat the shaft on clutch pedal. Install in reverse order of removal.

Using white grease, lightly coat the inside diameter of cable eyelet. Install cable in reverse order of removal.

CLUTCH

To test the clutch, apply the handbrake, foot brake, engage 4th gear, then with engine at fast idle, slowly release the clutch pedal. If the engine stalls, the clutch assembly is considered serviceable. Otherwise replace the clutch assembly.

REMOVAL

Remove transmission

If same clutch assembly is to be installed, mark position on flywheel so that correct balance will be maintained.

Remove clutch assembly (2 & 3) by gradually loosening and then removing six bolts (1).

1. Bolt
2. Pressure plate
3. Disc

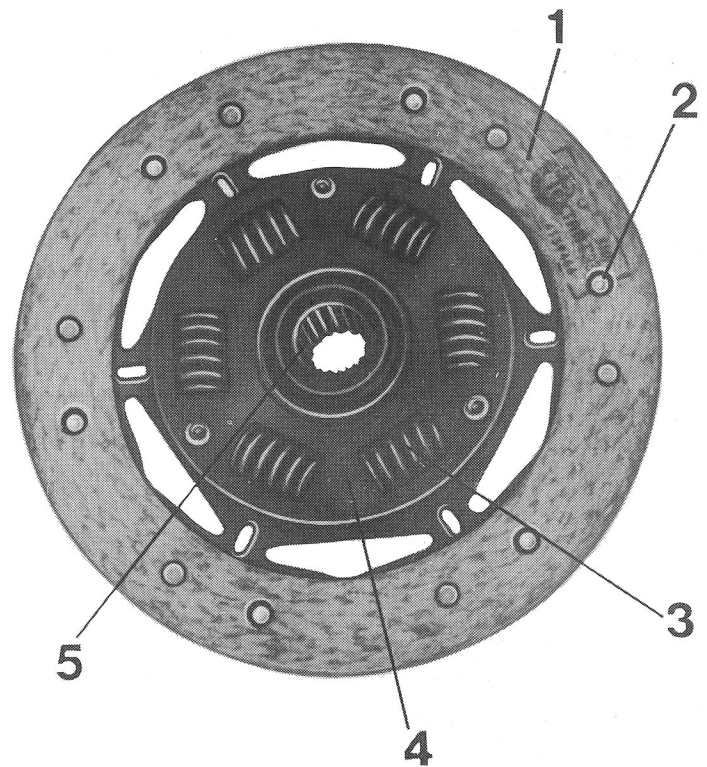
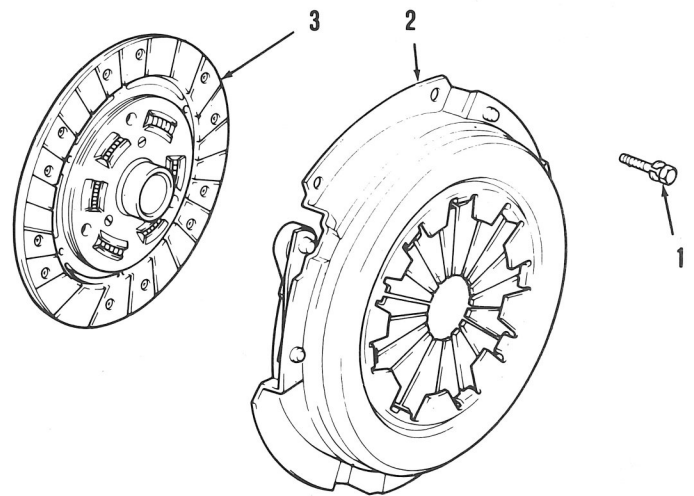
INSPECTION

Check that the surface of friction material (1) is not less than 1/16 in. (1,5 mm) from rivet heads (2) and is not cracked or glazed.

Check that the disc is not warped.

Check that springs (3), plate (4) or splines (5) are not damaged. Replace disc if damaged.

1. Friction material
2. Rivet head
3. Spring
4. Plate
5. Splines

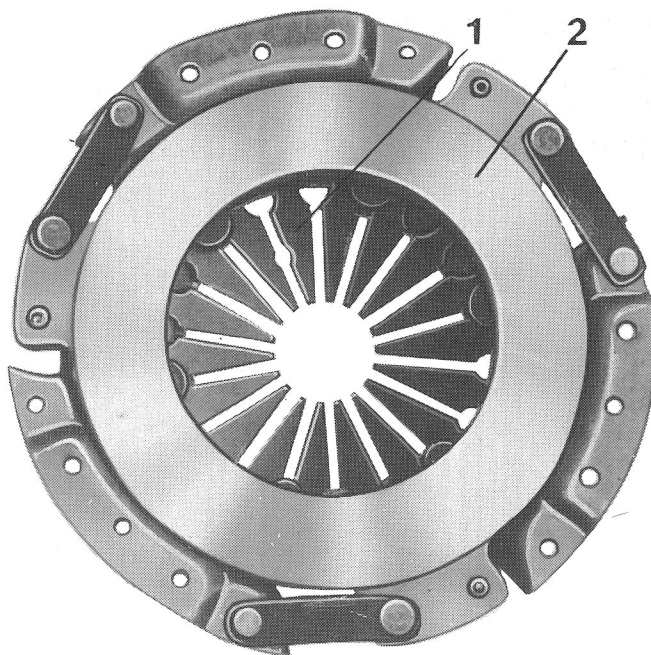


Check that fingers (1) of the diaphragm spring are not broken, cracked or misaligned.

Check facing (2) for heat cracks, scoring or burns.

For minor imperfections, dress the pressure plate with medium grit emery cloth. Replace if damaged. Check the mounting hardware for damage. Replace if damaged.

1. Fingers
2. Facing

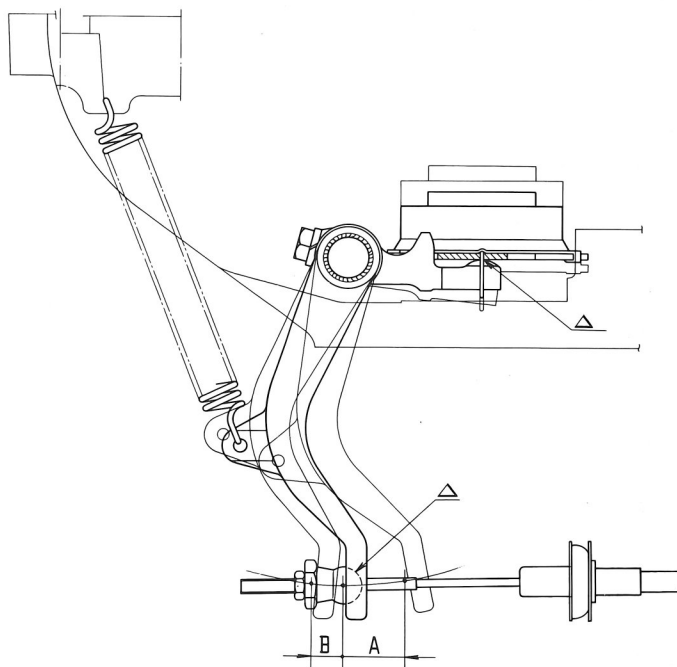


View of lever and throwout bearing

A = About 1 in. (25 mm) release travel, corresponding to a pressure plate displacement of .07 in. (1.778 mm).

B = About .5 in (12,5 mm) travel of clutch release lever as a result of plate lining wear.

Δ — Lubrication points



Clutch cover assembly checking diagram

1. Clutch cover 2. Pressure plate 3. Diaphragm spring ring 4. Diaphragm spring retaining plate 5. Diaphragm spring

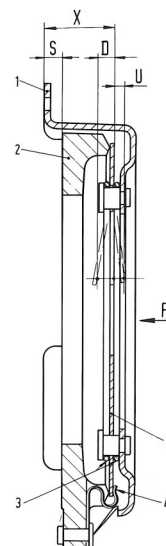
S = .32 in. (8,125 mm) thickness of ring for checking the clutch assembly

X = 1.32 in. (33,53 mm) required clutch assembly dimension

D = .33 to .34 in (8,636 mm) release travel

U = .17 in (4,318 mm) maximum permissible displacement due to disc lining wear

F = 286 lbs (129,41 kg) direction of load to be applied to check that .33 to .34 in (8,636 mm) release travel corresponds to a minimum pressure plate back travel of .017 in. (4,318 mm)



Throwout Bearing; Fork and Lever

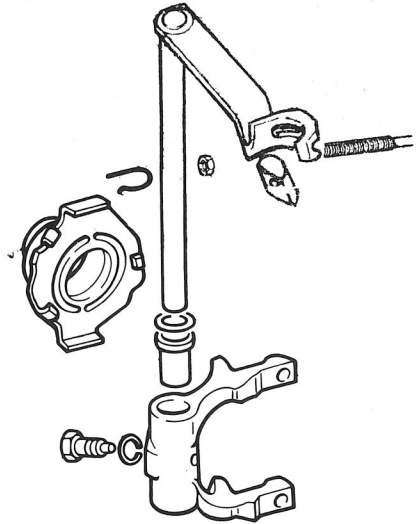
Check the throwout bearing for servicability. Replace it if worn.

Check that the spring clips are properly installed.

Check that the lever moves freely and does not bind. If binding, disassemble by removing the bolt and lockwasher.

Check the bearing surfaces, and check that the bushing is not worn. Replace the bushing if worn.

Check that the fork is not cracked or worn. Replace it if damaged. When replaced, torque the bolt to 19 ft. lbs (2.6 kgm).



Clutch Installation

If the flywheel was removed, torque mounting bolts to 61 ft. lbs. (8.5 kgm).

Make sure the clutch and flywheel surfaces are clean. If old clutch assembly is being installed, align marks made during removal.

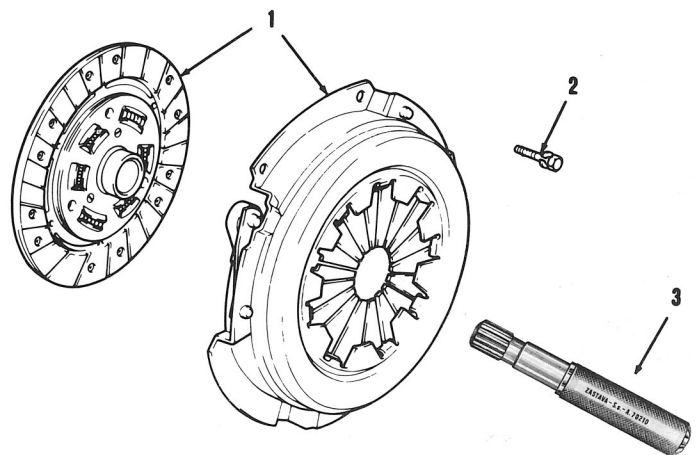
With protruding part of disc hub facing away from flywheel, loosely attach clutch assembly (1) on flywheel.

Using pilot tool A. 70210 (3), center disc in pressure plate.

Gradually torque mounting bolts (2) to 12 ft. lbs. (1.6 kgm). Remove pilot tool.

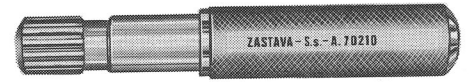
Lightly coat transmission shaft with white grease then install transmission as directed in TRANSMISSION section.

1. Clutch assembly 2. Bolt 3. Pilot tool



SERVICE TOOLS

A. 70210 Pilot, clutch plate centering.



TRANSMISSION – DIFFERENTIAL

TRANSMISSION - DIFFERENTIAL

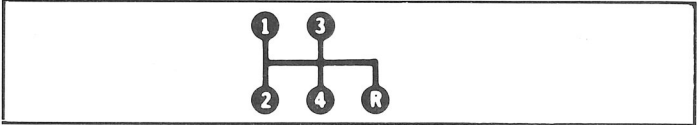
4 SPEED

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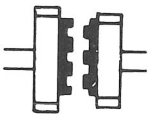

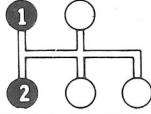

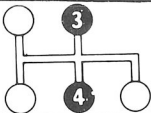


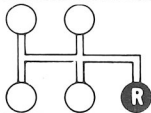

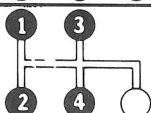

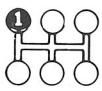
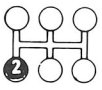
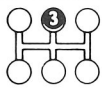
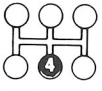
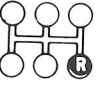
5 SPEED

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SERVICE TOOLS	3 - 37


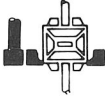
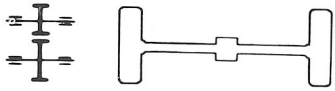





SPECIFICATIONS


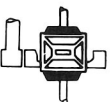






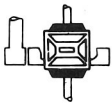








GEARBOX

 SYNCHRONIZERS	BORG-WARNER TYPE SYNCHRONIZER 	
	PORSCHE TYPE SYNCHRONIZER 	
 GEARS	STRAIGHT TEETH 	
	HELICOIDAL TEETH 	
 DRIVE RATIO		3,583
		2,235
		1,454
		1,042
		3,714

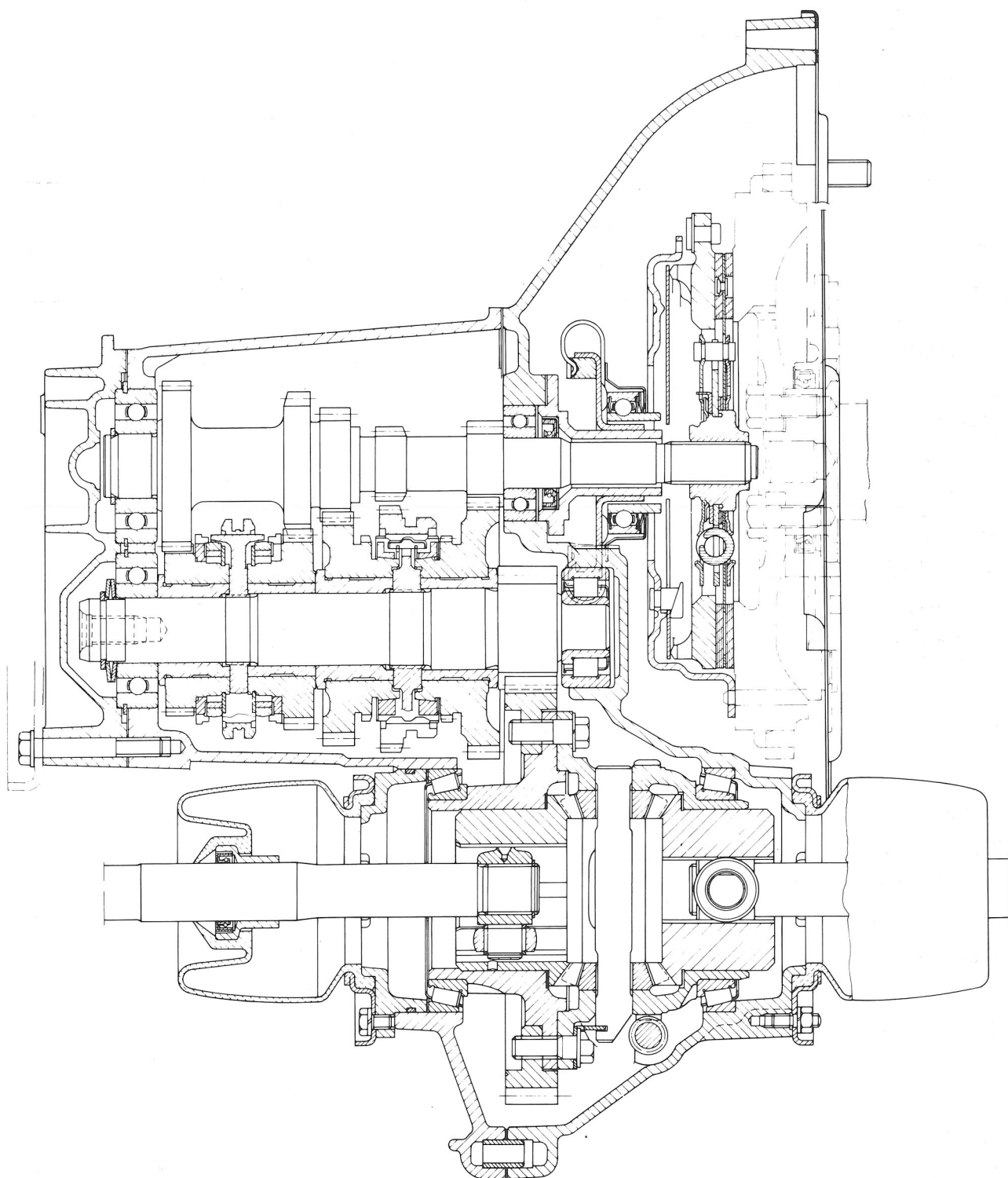
DIFFERENTIAL

 REDUCTION DRIVE RATIO 		3.765
 OVERALL REDUCTION RATIO		13.488
		8.414
		5.473
		3.923
		13.967

		in	mm
		 TAPERED ROLLER	
DIFFERENTIAL BEARINGS			
ADJUSTMENT OF TURNING RESISTANCE	  	 SHIMS	
SHIM THICKNESS	 	.020 — .024 — .028 .031 — .035 — .040 — .043	0,50 — 0,60 — 0,70 — 0,80 — 0,90 — 1,00 — 1,10
PRELOAD OF SIDE BEARINGS		S-P-H + .003	S-P-H + 0,08
BACKLASH BETWEEN DIFFERENTIAL SIDE GEAR AND PINION		.004	0,10
ADJUSTMENT OF BACKLASH BETWEEN DIFFERENTIAL SIDE GEAR AND PINION	 	 SHIMS	
SHIM THICKNESS	 	.0335 — .0354 — .0374 .0394 — .0413 — .0433 .0453 — .0472 — .0492	0,85 — 0,90 — 0,95 — 1,0 — 1,05 — 1,10 — 1,15 — 1,20 — 1,25

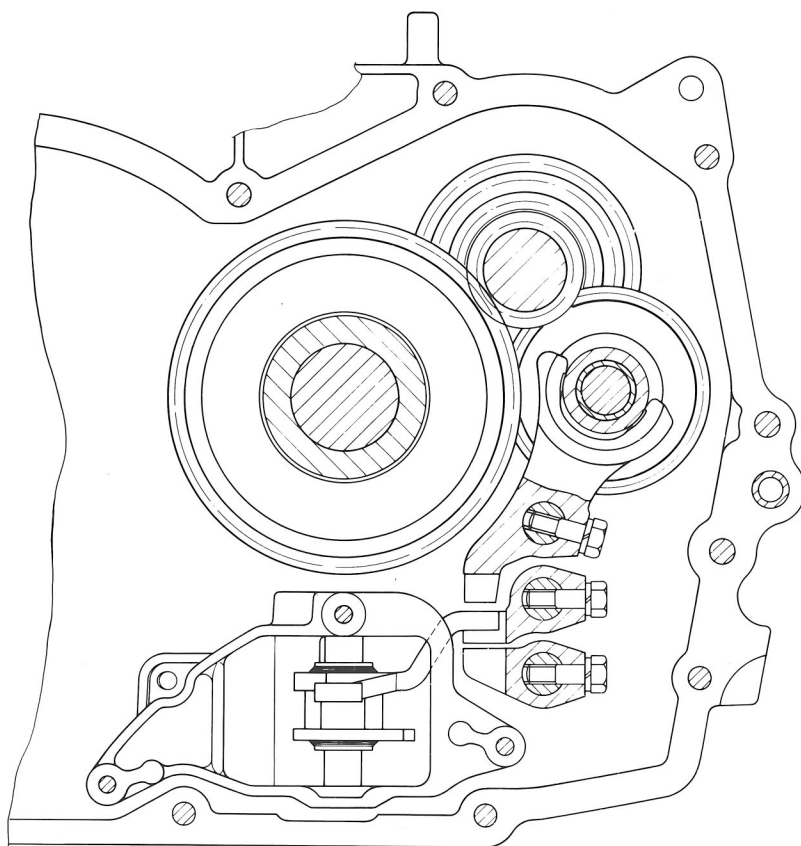
TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Torque		
		Ft. Lb	Kgm	Nm
Selector lever spring bolt	M 8	18,5	2,5	25
Rear cover bolt/nut	M 6	7,4	1,0	10
Bell housing bolt/nut	M 12 x 1,5	57,5	7,9	78
Transaxle case bolt/nut	M 8	18,5	2,5	25
Rear cover bolt/nut	M 6	7,4	1,0	10
Transaxle mount bolt	M 12 x 1,25	57,5	7,9	78
Reverse idler shaft nut	M 6	7,4	1,0	10
Shift fork bolt	M 6	13,3	1,8	18
Selector lever bolt	M 6	13,3	1,8	18
Selector housing nut	M 6	7,4	1,0	10
Ring gear bolt	M 10 x 1,25	60	7,0	69
Axle boot flange bolt	M 6	7,4	1,0	10
Axle boot flange nut	M 6	5,7	0,79	7,8
Transaxle case bolt/nut	M 8	18,5	2,5	25

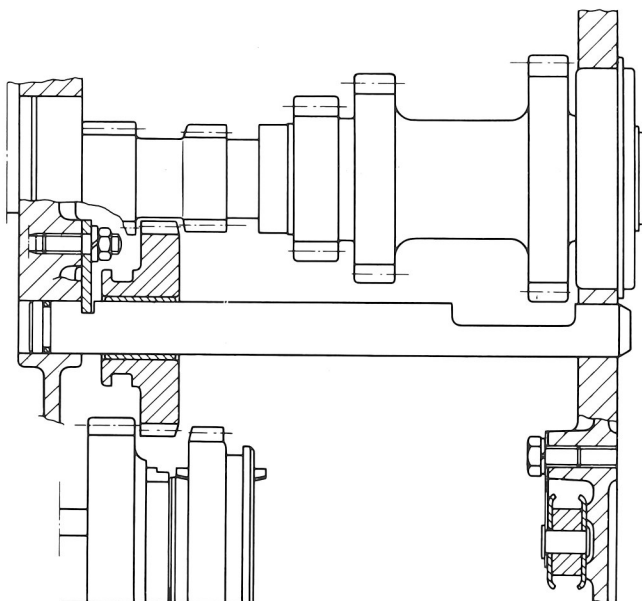


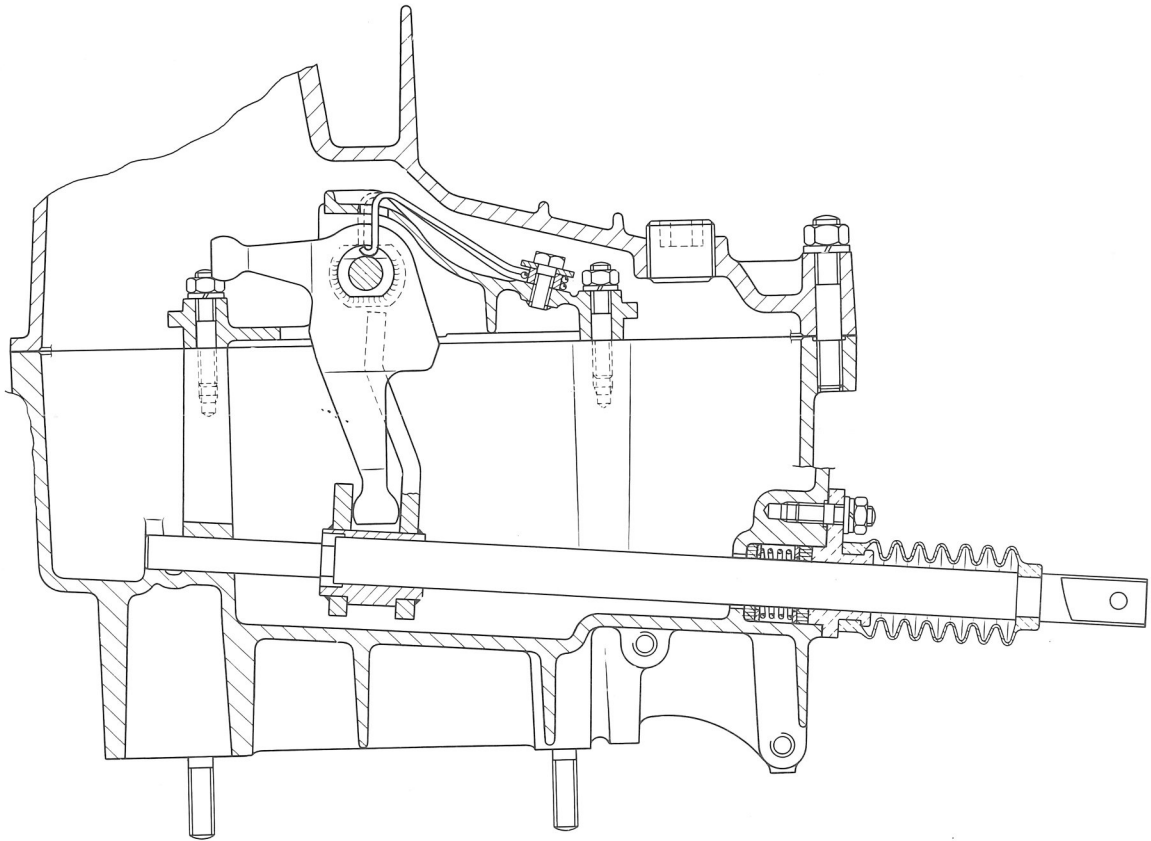
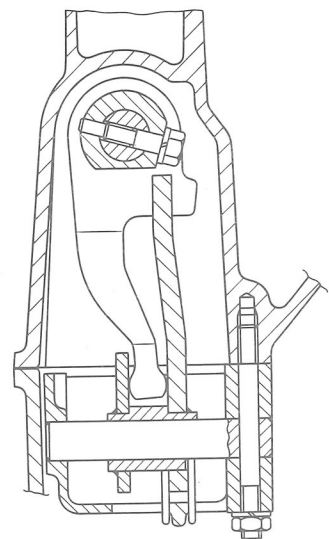
Transmission and differential assembly cross section

Section through gear control dogs

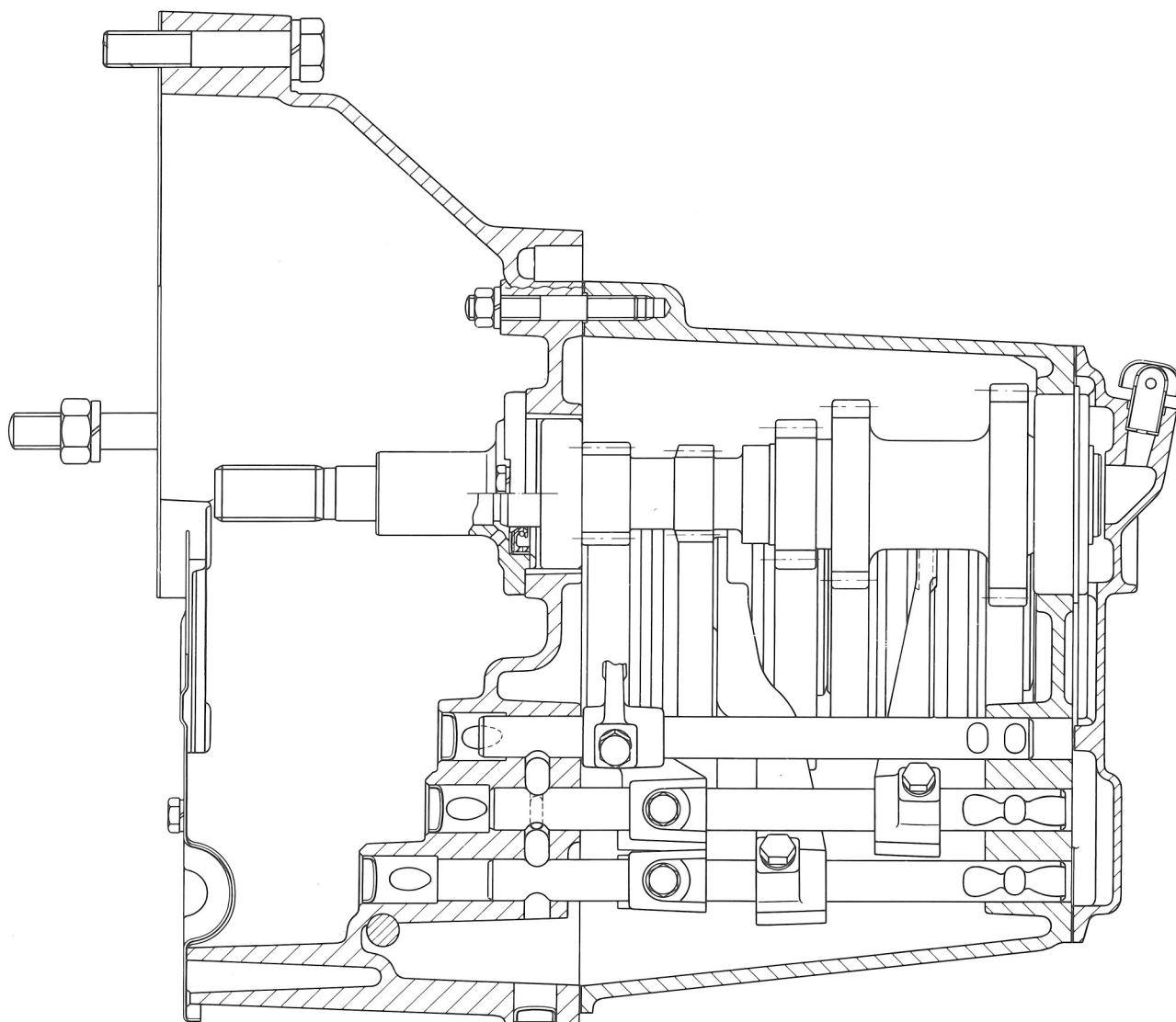


Section through reverse idler gear



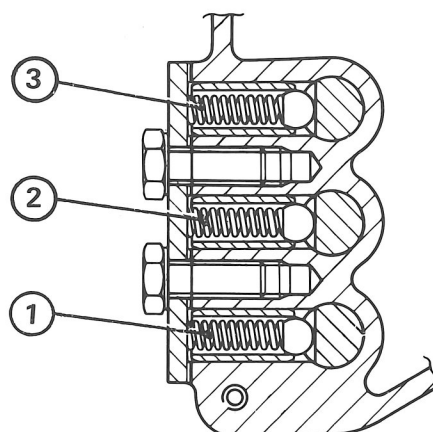
Longitudinal section of gearshift rod**Cross section through gear selector lever**

Longitudinal section of transmission



Section through detent springs for shift rails

1. First and second gear spring (blue)
2. Third and fourth gear spring (not colored)
3. Reverse spring (green)



REMOVAL AND INSTALLATION OF ASSEMBLY

The following procedures are used in removing the transaxle assembly from the car. The various operations should be carried out after the car has been set on stands, the hood has been raised and the protective covers arranged on the fenders.

Perform the following operations from above the car and inside the engine compartment.

- disconnect the positive cable from the battery terminal
- remove the spare tire
- remove the speedometer cable from the transmission housing by unscrewing the ring nut
- disconnect the clutch cable from the release lever and unhook the return spring
- install a device to support the engine assembly
- unscrew the bell housing bolts from above

Remove the hub caps from the front wheels and unscrew the constant velocity joint hub nuts

Take off the left wheel

Disconnect the left tie rod from the steering arm using remover A.47035.

Remove the sway bar by unscrewing the nuts on the control arms and the bolts for the two brackets on the body.

Remove the bolt holding the control arm to the body.

Working underneath the car:

- disconnect the backup light switch wires
- disconnect the exhaust pipe bracket
- disconnect the gearshift linkage
- remove the starter
- remove the flywheel cover
- remove the lower support crossmember
- remove the remaining bell housing bolt and nut
- disconnect the ground cable from the assembly
- using wire, support the axle shafts and CV joints to the transaxle
- carefully lower the transaxle assembly from the car

To reinstall, reverse the above procedures.

DISASSEMBLY

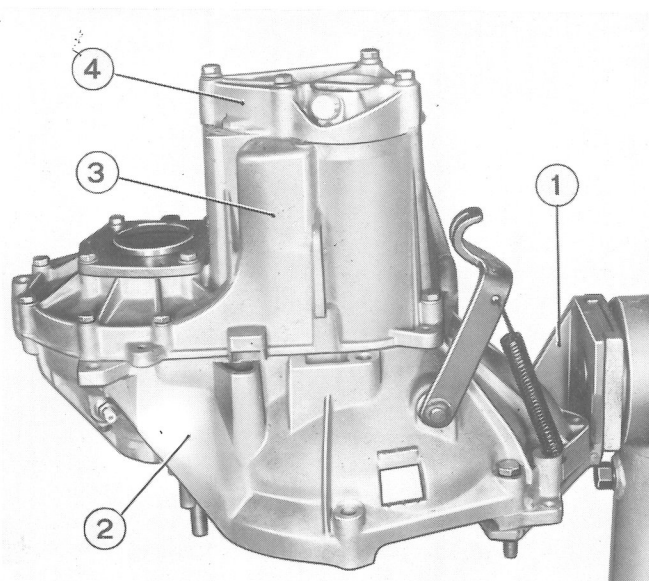
Secure support A. 71001/14 to a transmission stand. Install the unit in the support (1).

Remove lower drain plug and allow the oil to drain. Remove the backup switch.

Remove the nuts and bolts holding the axle boot flange to the differential. Remove the axle shafts from their seats in the differential.

Remove the bolts and remove cover (4) and gasket.

1. Support A. 71001/14
2. Bell housing
3. Main case
4. Rear cover

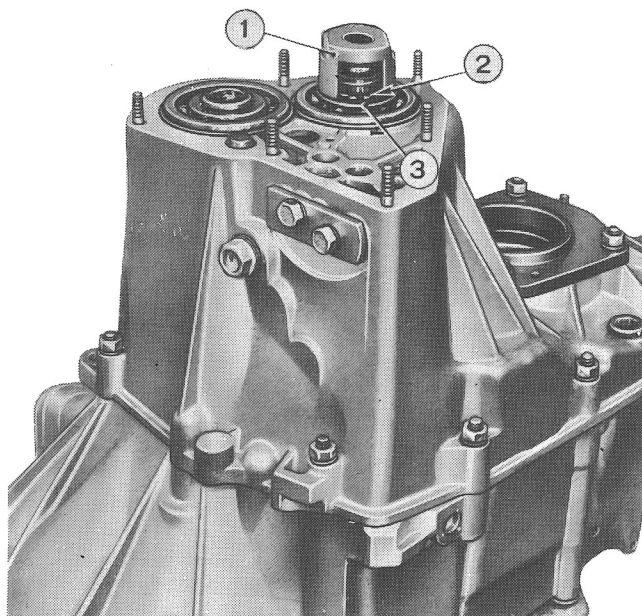


Remove the snap ring from the mainshaft.



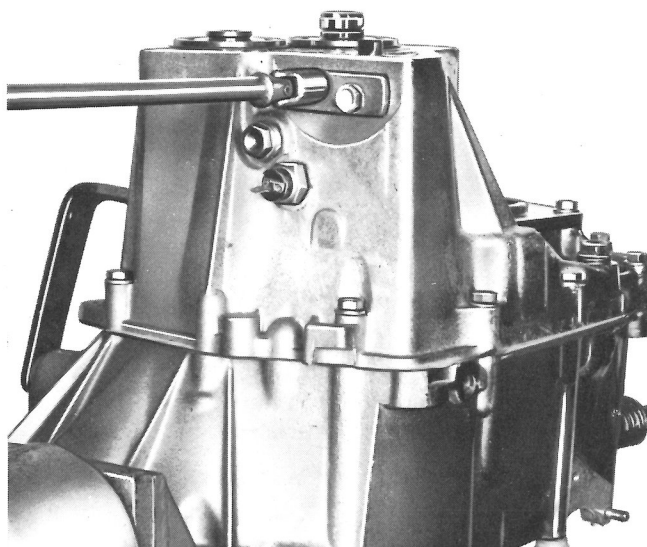
Place transmission/differential in a press. Install tool A. 70284 (1) on the spring washer (2). Compress the »Belleville« type spring washer and remove the snap ring (3).

1. Tool A. 70284
2. Spring washer
3. Snap ring



Remove the two bolts holding the detent spring cover. Carefully remove the cover and gasket so that the springs do not fall out.

Using a magnetic tool, remove the detent balls from their respective shafts.

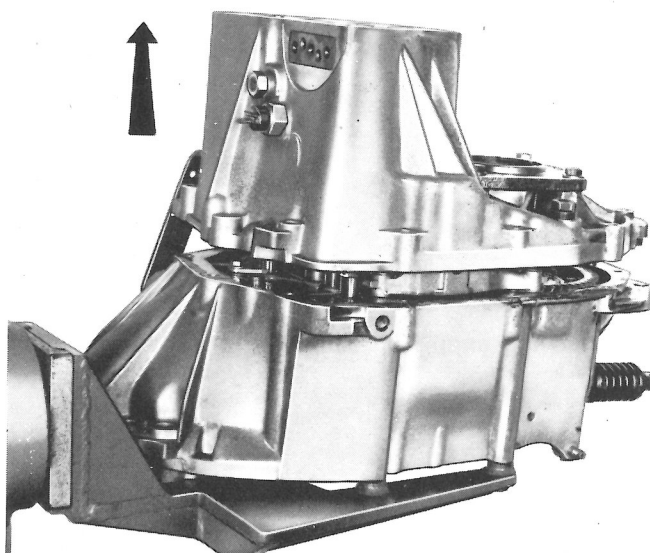


Remove the nuts inside the bell housing holding the main case. Remove the nuts holding the main case to the bell housing. Lift the main case off the bell housing.

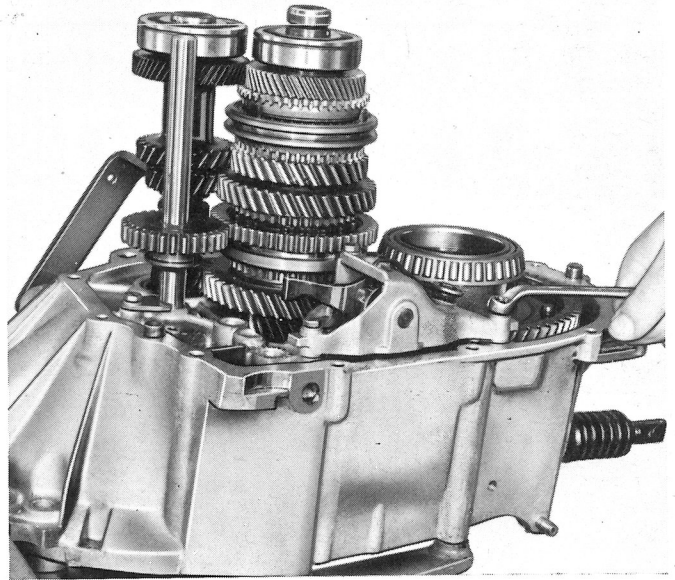
Arrow shows direction of lifting main case from bell housing.

Remove the bolts holding the gearshift forks to the selector rods. Remove the forks and rods from their seats in the housing.

NOTE: Do not lose the interlock pin from the 3rd and 4th gear shift rod. The other two interlock plungers will be in their bores in the bell housing, and may be removed with a magnet.



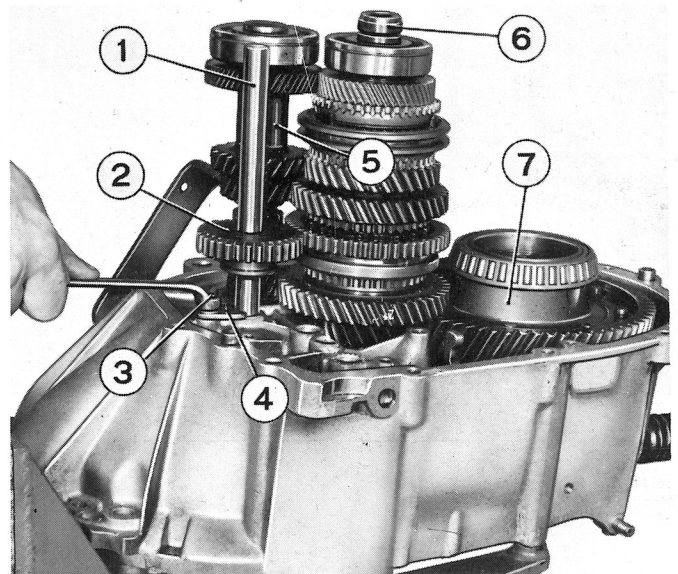
Remove the bolts holding the selector lever housing and remove the housing.



Remove bolt (3) holding reverse idler shaft retaining plate (4). Remove reverse shaft (1) and retaining plate (4).

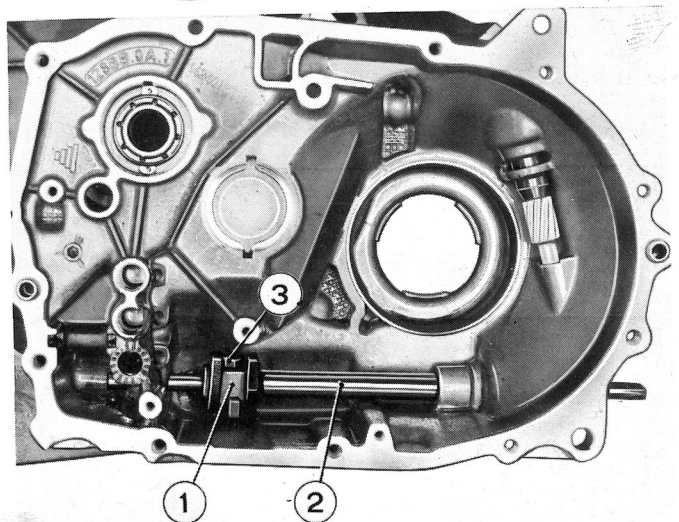
Lift out mainshaft (6) and countershaft (5) together. Remove their bearings from the housing. Lift out differential assembly (7) from the housing.

1. Reverse shaft
2. Reverse idler
3. Bolt
4. Retaining plate
5. Countershaft
6. Mainshaft
7. Differential assembly



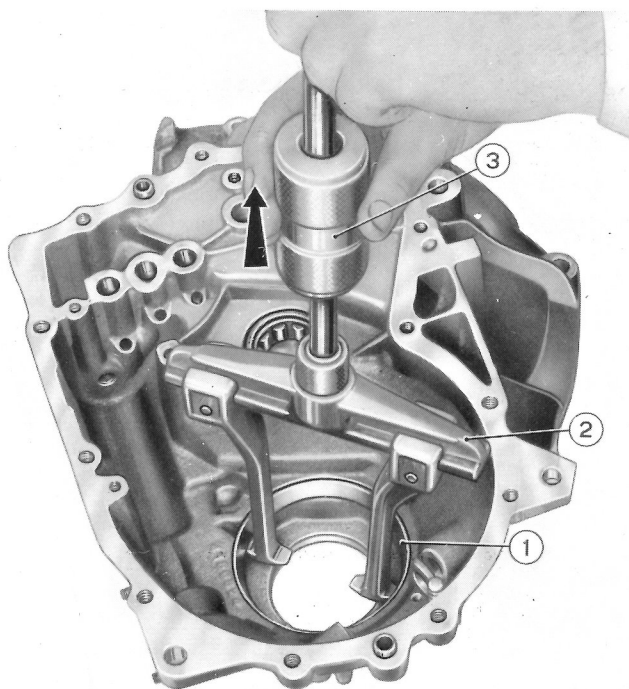
Remove bolt (3) holding shift lever (1) to shift rod (2). Slide shift rod out of the housing.

1. Shift lever
2. Shift rod
3. Bolt



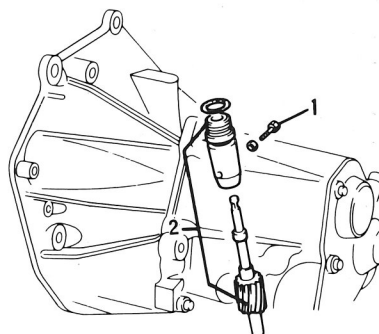
Assemble tool A. 40206 (3) to A. 40005/003/303 (2). Place tool A. 40005 (2) in differential bearing outer race (1). Using tool A. 40206 as a slide hammer, remove the outer race.

1. Outer race
2. Tool A. 40005/033/302
3. Tool A. 40206



Remove locking bolt (1) holding speedometer drive (2) in transmission housing. Withdraw the speedometer drive assembly. Installation is reverse of removal.

1. Locking bolt
2. Speedometer drive assembly



INSPECTION

MAIN CASE, BELL HOUSING AND REAR COVER

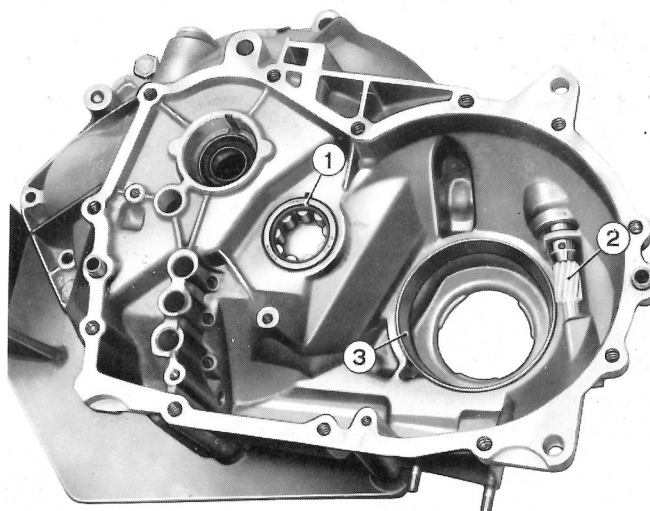
Check the cases for cracks. Check the bearing seats for wear or damage that might cause the bearing cups to rotate in their seats.

The main case mating surfaces should not show signs of damage, otherwise the assembly will be misaligned and oil leakages will result from inadequate gasket sealing.

Minor imperfections can be removed with a file. In cases of extensive damage or excessive wear, replace the affected part.

Make sure the oil breather on the rear cover is not clogged.

1. Countershaft roller bearing
2. Speedometer drive gear
3. Differential bearing outer race

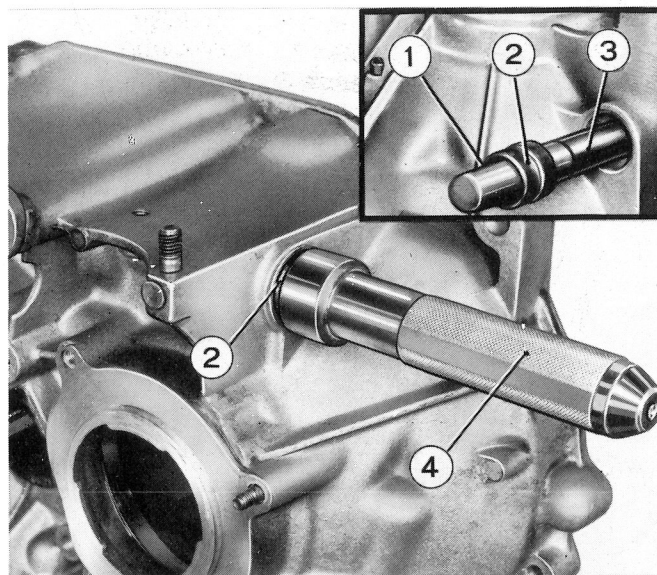


SEALS

Replace all seals.

Installing the sealing ring for the shift rod.

1. Tool A. 70301 for installing the sealing ring
2. Sealing ring
3. Shift rod
4. Driver A. 70296 for installing the sealing ring



SHAFTS

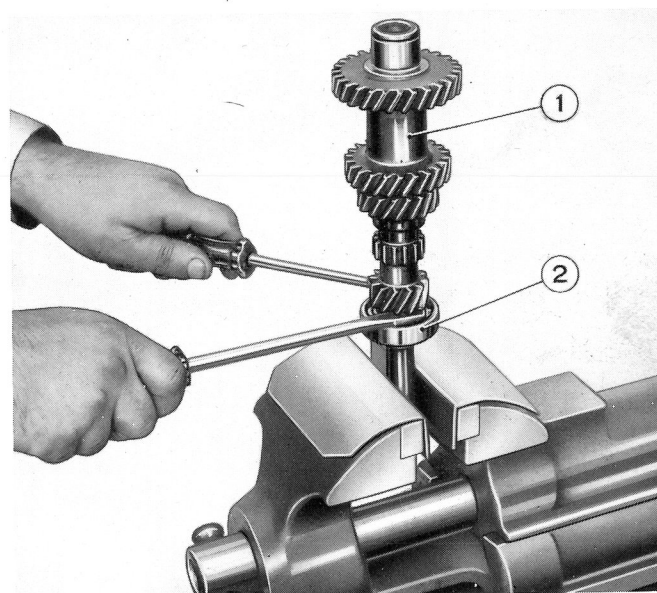
Inspect the countershaft gears for signs of chipping or excessive wear.

1. Countershaft
2. Ball bearing

Check that the surfaces of the shaft are not damaged or excessively worn.

Minor imperfections on working surfaces that do not render the parts unfit for service may be dressed with extra-fine emery cloth.

Minor distortions of shafts can be corrected in a small press, taking care not to damage their surfaces. If shafts are badly distorted, they must be replaced.



Remove the bearing from the mainshaft using a universal puller. Slide the gears, sleeves, and bushings from the shaft.

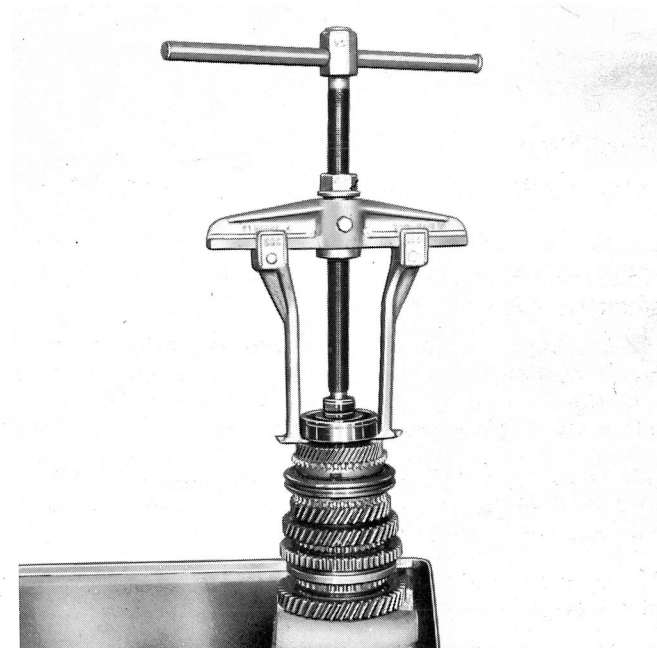
Check that the splines are free from nicks or burs so that the hubs slide freely.

Bearings must be in perfect condition. End play must not exceed 0,019 in. (0,50 mm) and side play .002 in. (0,050 mm). Hold the bearing firmly and turn it both ways by hand to check for roughness.

Replace all bearings that are not in perfect condition.

The surface of the reverse shaft should be smooth and free from nicks and burrs.

The clearance between the reverse shaft and the bushing on the reverse idler gear must be .003 in to .006 in. (0,08 to 0,15 mm).



GEARS, HUBS, SLEEVES, AND FORKS

Gears should not show damage or excessive tooth wear.

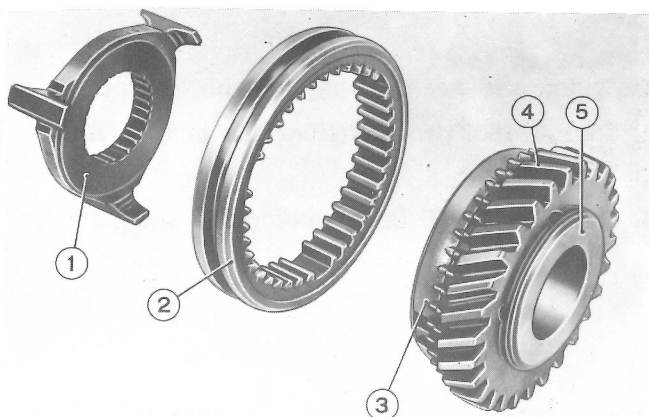
The gear tooth contact pattern must extend across the entire working surface. Inspect the pattern for roughness or signs of wear.

Check the gear backlash. This should be .004 in. (0,10 mm) for new parts. Maximum allowable backlash is .008 in. (0,20 mm).

The fit clearance between bushings and gears is .0016 to .003 in. (0,040 to 0,080 mm).

Replace gears showing evidence of wear beyond the specified limits or damage.

1. Sleeve hub 2. Sliding sleeve 3. Synchronizer ring 4. Gear 5. Bushing



Check that the sliding sleeves and hubs are not nicked, especially on the sleeve sliding surface.

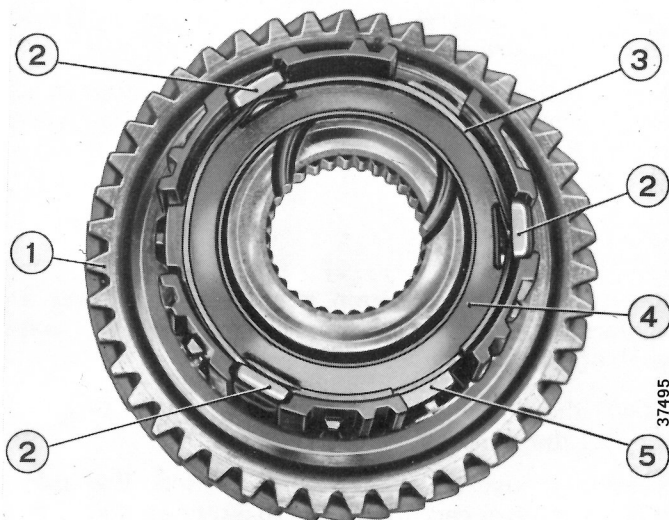
Check that the tooth surfaces are not worn. Wear patterns should be the same on both sides of the forks.

SYNCHRONIZERS

The synchronizer rings must not be excessively deteriorated, either on their inside surface or on the teeth that mesh with the sliding sleeves, and the ring must not be loose in its gear seat.

Borg - Warner type: Installed view

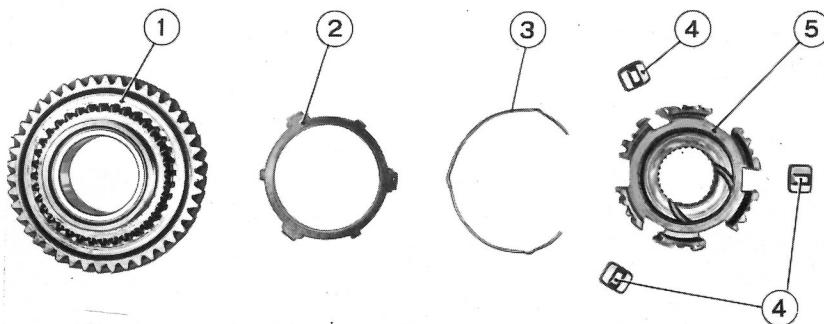
1. Gear 2. Insert 3. Retaining spring 4. Sliding sleeve hub 5. Synchronizer ring



If splined parts do not slide smoothly, remove the obstacle with a very fine file. Parts worn beyond allowable limits must be replaced.

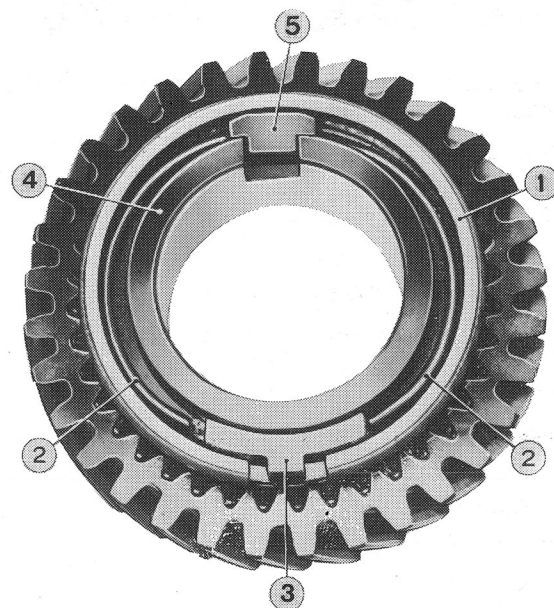
Exploded view

1. Gear
2. Synchronizer ring
3. Retaining spring
4. Insert
5. Sliding sleeve hub

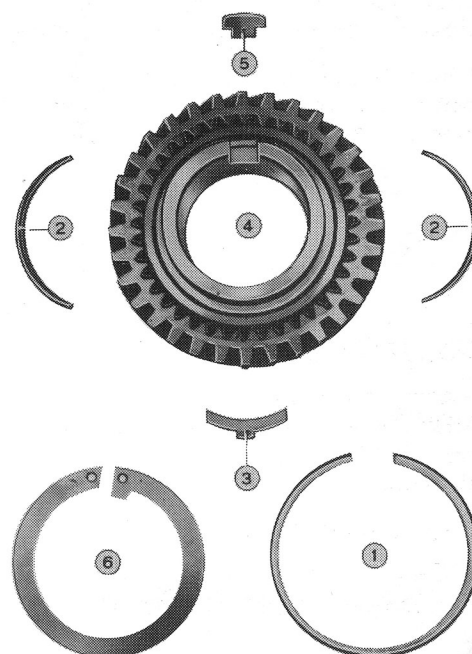


Porsche type: Installed view

1. Synchronizer
2. Thrust ring
3. Thrust block
4. Gear
5. Stop block

**Exploded view**

1. Synchronizer
2. Thrust ring
3. Thrust block
4. Gear
5. Stop block
6. Snap ring

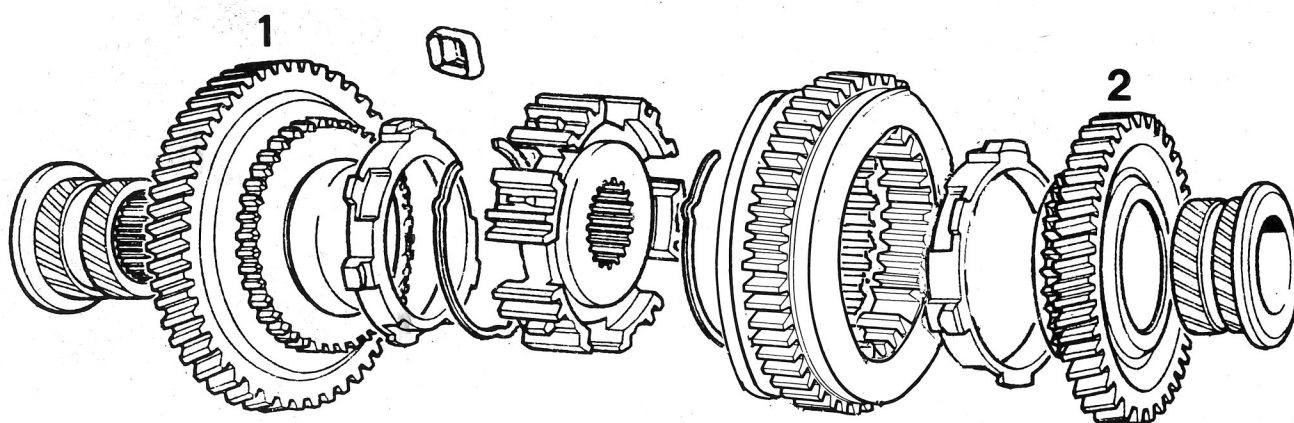


NOTE: Always use a new snap ring when reassembling 3rd and 4th gear synchronizers.

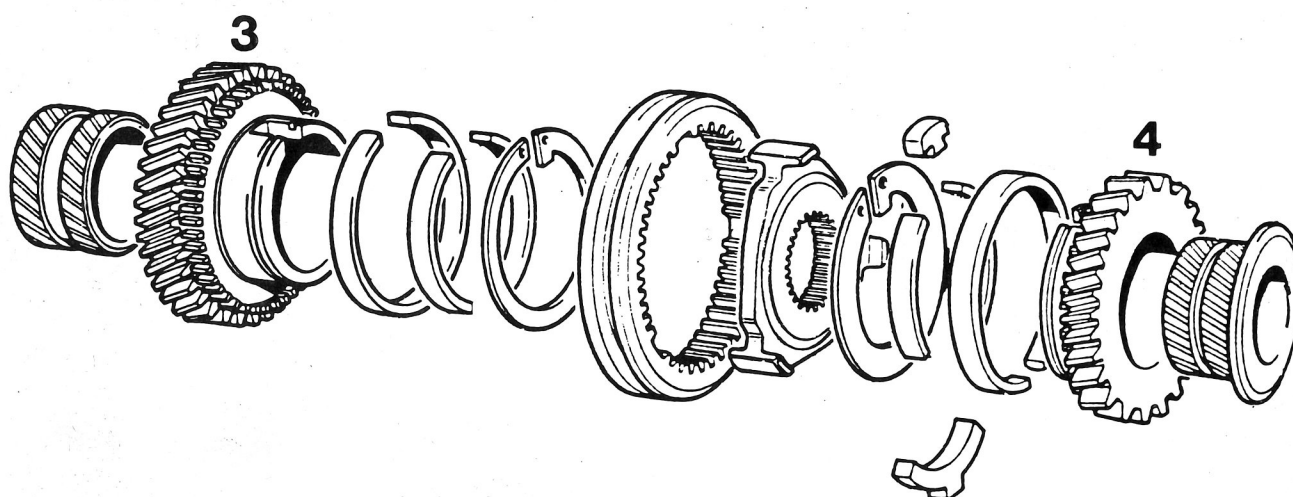
Install the snap ring to the gear using tool A. 70100

1. Snap ring
2. Synchronizer
3. Gear
4. Thrust spring





Exploded view of 1 st and 2nd gears



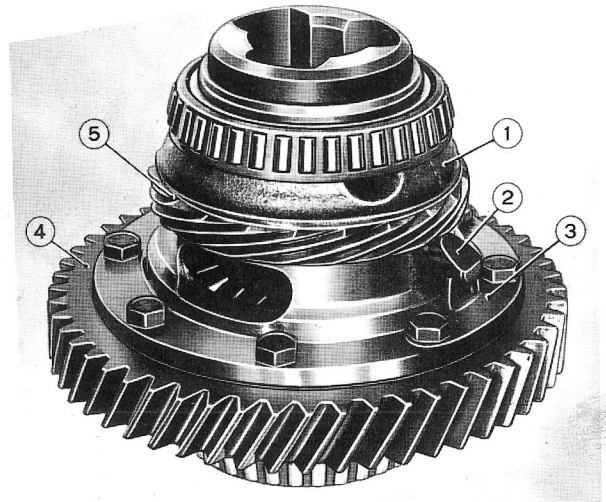
Exploded view of 3 rd and 4 th gears

DIFFERENTIAL DISASSEMBLY

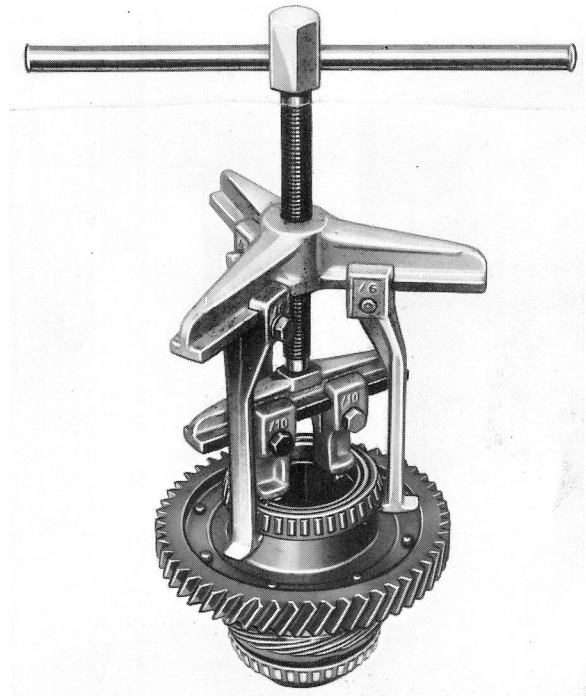
To disassemble the differential proceed as follows:

- remove the roller bearings from their seats on the cases using the three-armed puller **A. 40005/003** with extraction brackets **A. 40005/302**, reaction yoke and reaction struts.

1. Case half
2. Pinion shaft
3. Lock plate
4. Ring gear
5. Speedometer drive

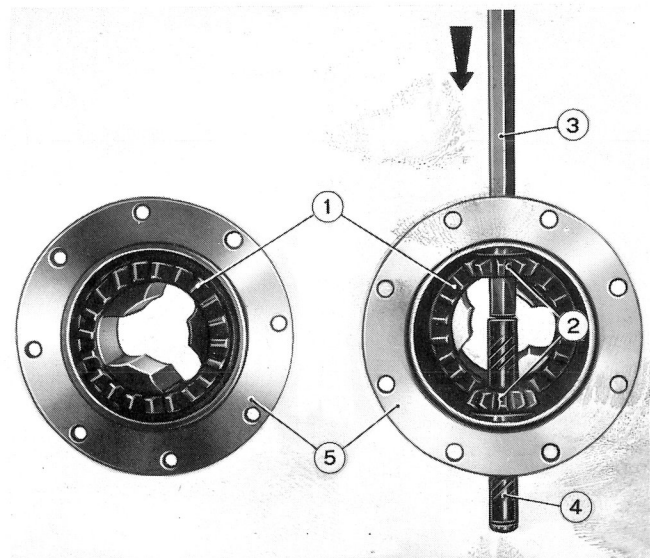


- unscrew the eight case bolts which also hold the ring gear

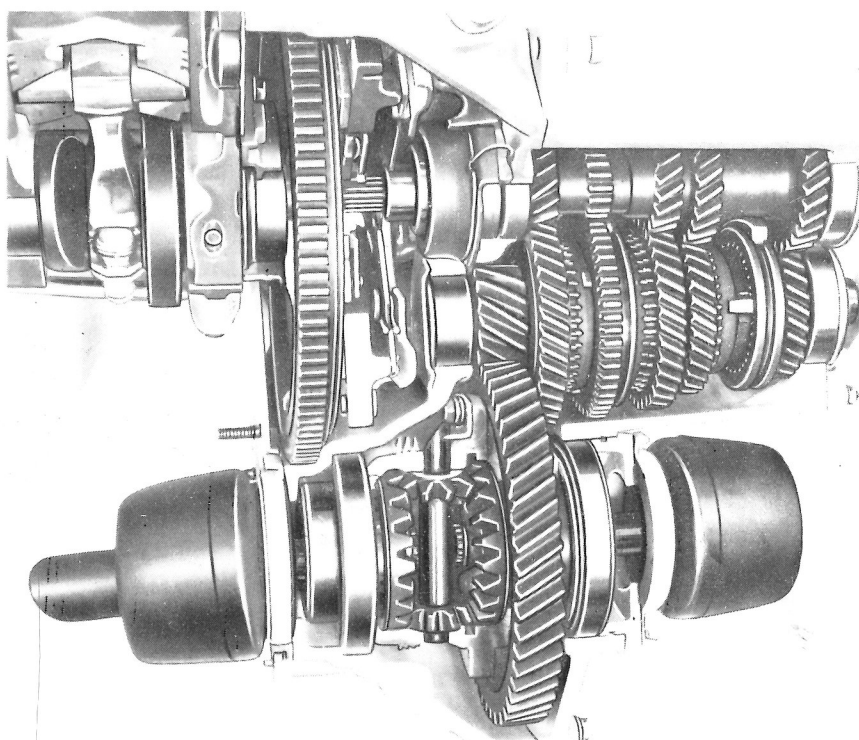


- remove the pinion shaft lock plate
- remove the pinion shaft from its case
- then break down the case-halves into their component parts.

1. Side gears
2. Pinion gears
3. Driver
4. Pinion shaft
5. Case halves



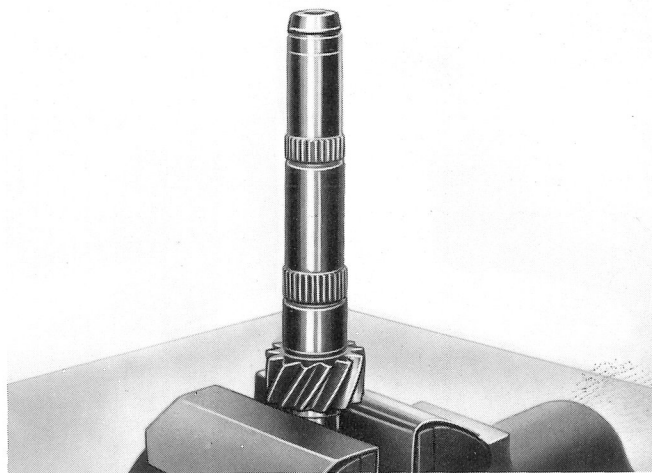
Sectioned view of transmission-differential assembly



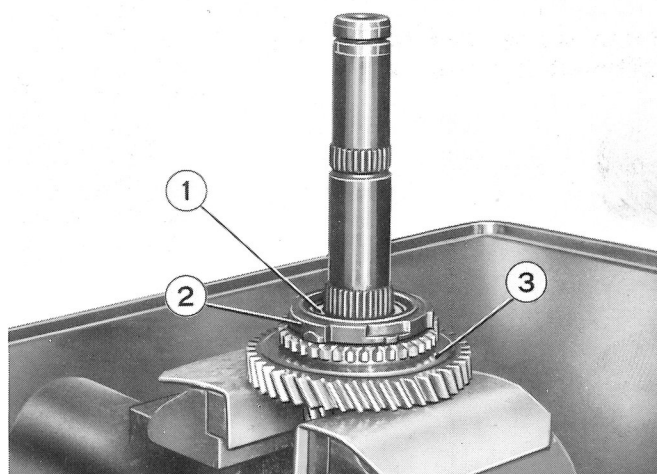
Inspect roller bearings. These should be in perfect condition with no signs of wear and should have perfectly smooth surfaces. If there is any doubt as to their serviceability, replace them, as faulty operation of bearings will result in gear noise and/or seizure.

ASSEMBLY OF TRANSMISSION**MAIN SHAFT AND GEARS**

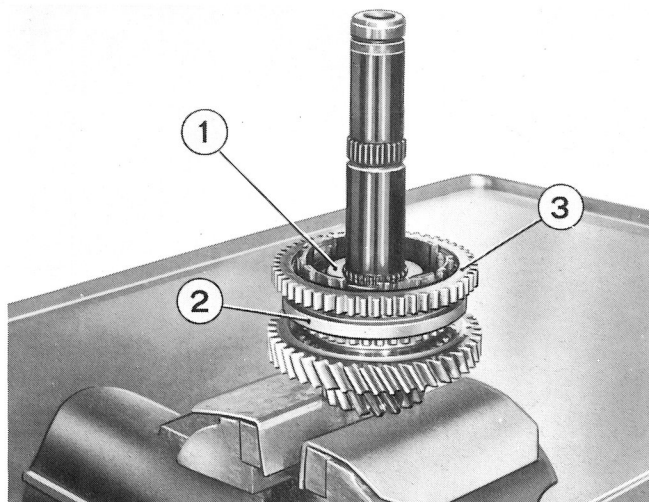
To assemble the mainshaft group, proceed as shown in the following figures. After completion of assembly operation install the ball bearing.

Shaft set for assembly of gears**Assembly of 1st driven gear**

1. Bushing
2. Synchronizer
3. Gear

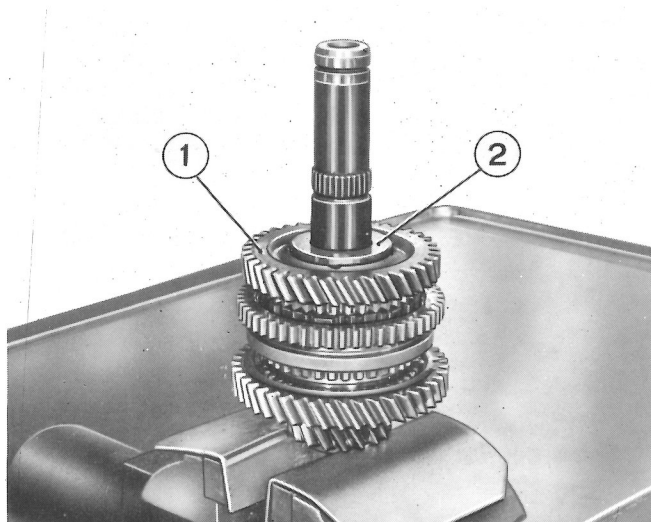
**Assembly of reverse driven gear/1st and 2nd gear shift sleeve**

1. Hub
2. Sleeve
3. Reverse gear teeth



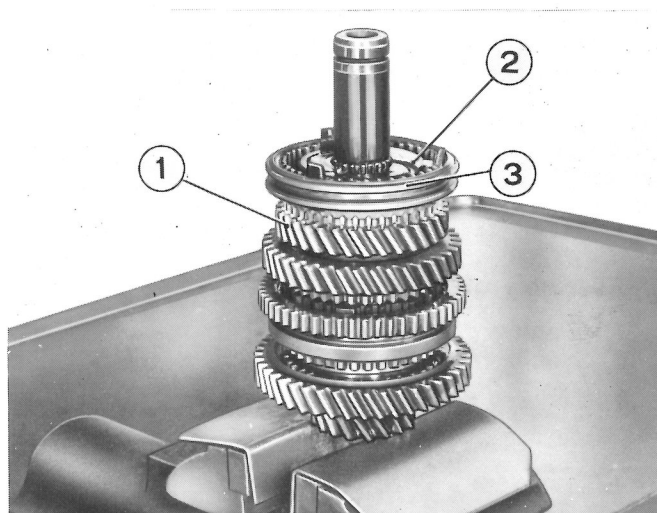
Assembly of 2nd driven gear

1. Gear with synchronizer
2. Bushing



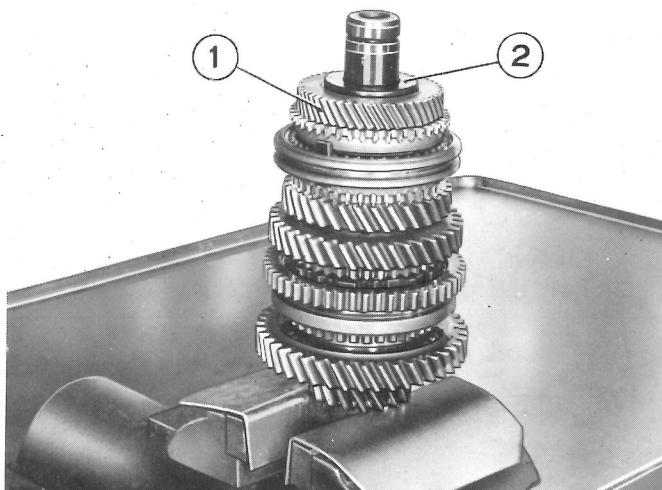
Assembly of 3rd driven gear and 3rd and 4th gear shift sleeve

1. Gear with synchronizer and bushing
2. Hub
3. Sleeve



Assembly of 4th driven gear

1. Gear with synchronizer
2. Bushing

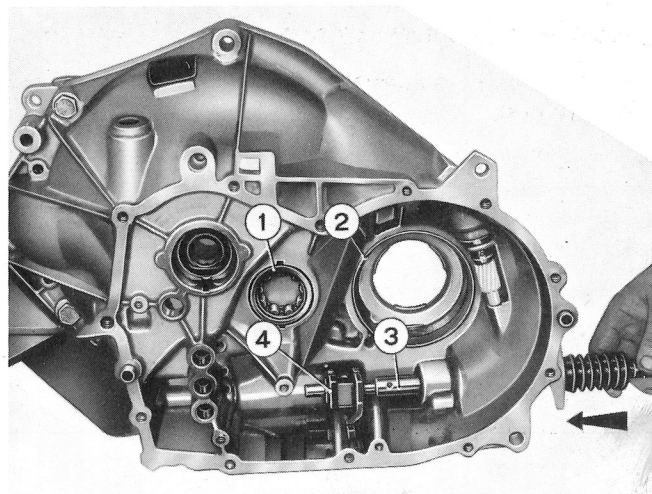


ASSEMBLY OF TRANSAXLE

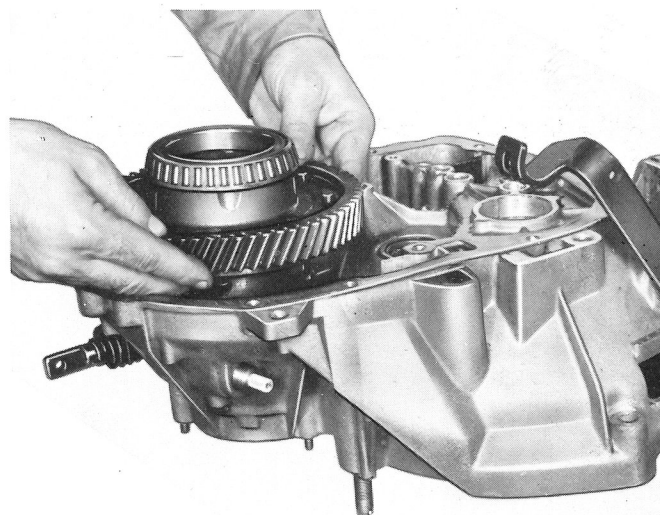
To assemble transmission components proceed as follows:

- install the transmission housing on stand **A. 71001/14**;
- install the countershaft roller bearing and, using an appropriate driver, the outer ring of the differential roller bearing;
- install the gearshift control rod in the housing, complete with spring, gaskets, cover and boot, and install control lever.

1. Bearing 2. Differential bearing outer ring 3. Gear control rod 4. Control lever

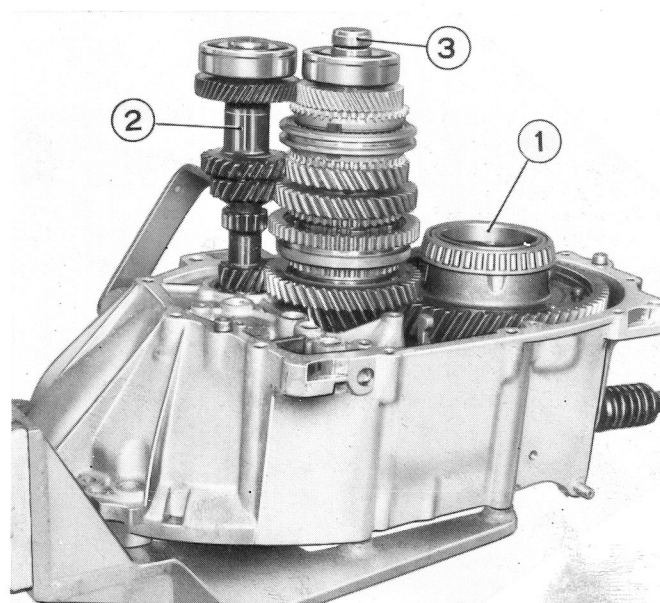


- install the differential assembly in the housing



- install the mainshaft and countershaft together into the housing.

1. Differential 2. Countershaft 3. Mainshaft

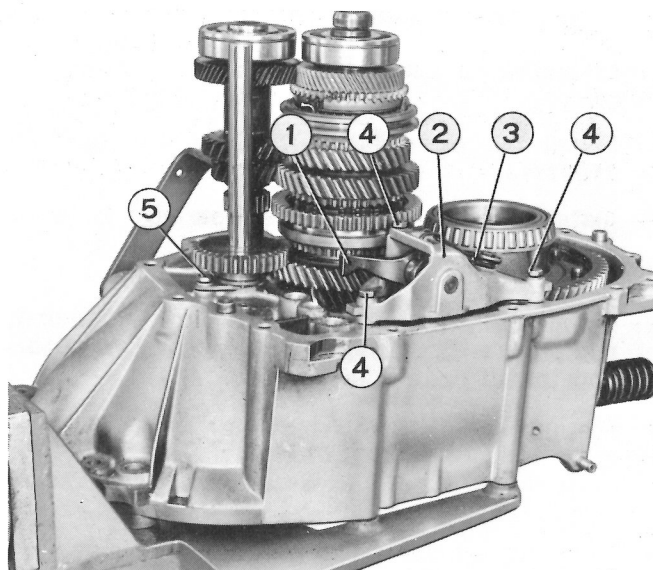


- insert reverse idler shaft, with o-ring, lock-plate and nut;
- install the gasket between the bell housing and transmission case;

NOTE: When assembling, make sure the gear selector and engagement lever lower end is securely lodged in its seat on the control lever fixed to the rod.

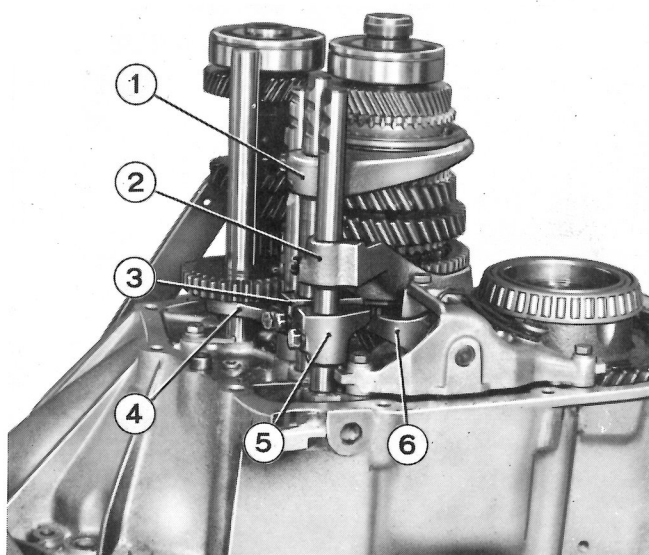
- install the selector and engagement lever.

1. Lever
2. Support
3. Spring
4. Housing retaining nuts
5. Reverse idler shaft nut and plate



- insert the interlock plungers in their bores in the case and then install the shift rods, forks and dogs.

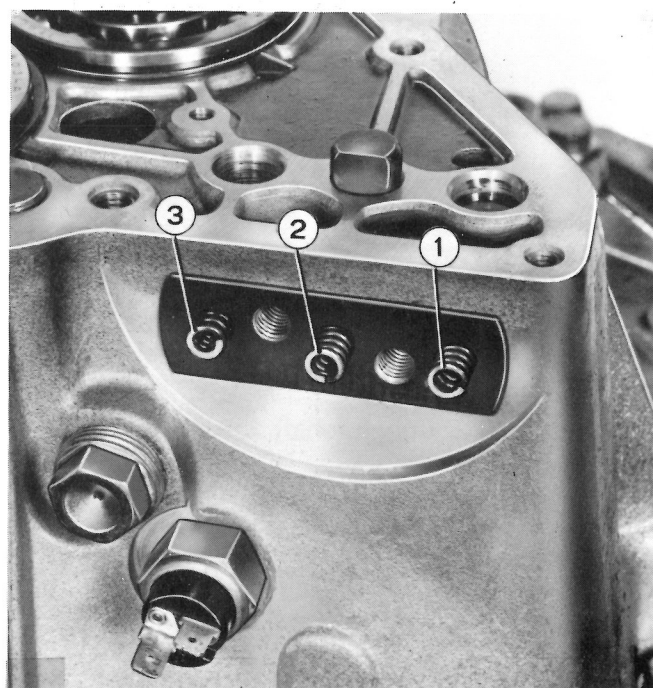
1. 3rd and 4th gear fork
2. 1st and 2nd gear fork
3. 3rd and 4th gear dog
4. Reverse fork
5. 1st and 2nd gear dog
6. Gear selector and engagement lever



NOTE: Make sure the interlock pin stays in the 3rd and 4th gear shift rod while it is being installed.

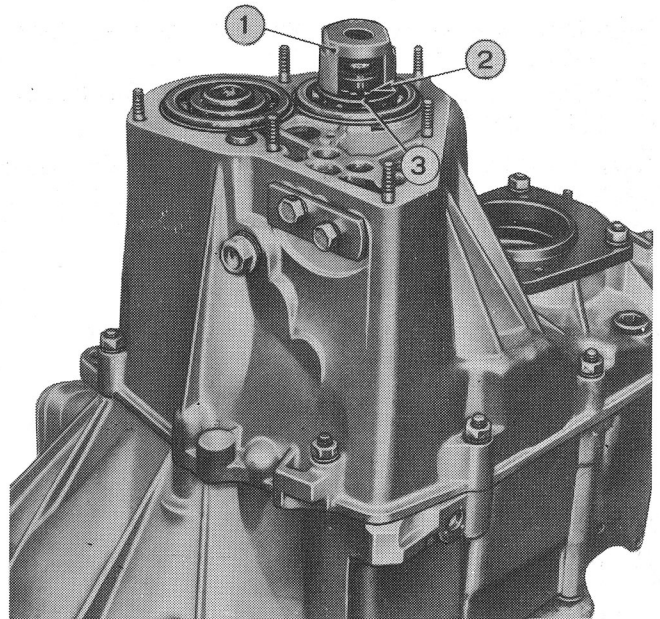
- install the transmission case on the bell housing and lock it with nuts;
- insert the three detent balls and springs and then install the spring retaining cover, and the gasket;
- install the ball bearings on the mainshaft and countershaft;

1. 1st and 2nd detent spring (blue)
2. 3rd and 4th detent spring (not colored)
3. Reverse detent spring (green)



- install the two spring washers on the mainshaft with their cupped sides facing each other;
- install the retaining snap ring using tool A. 70284 in a press.

1. Tool A. 70284 — 2. Snap ring — 3. Spring washers



- fit the cover and the gasket;
- **set differential bearings** as specified on the following page;
- install the clutch release fork and the sliding sleeve;

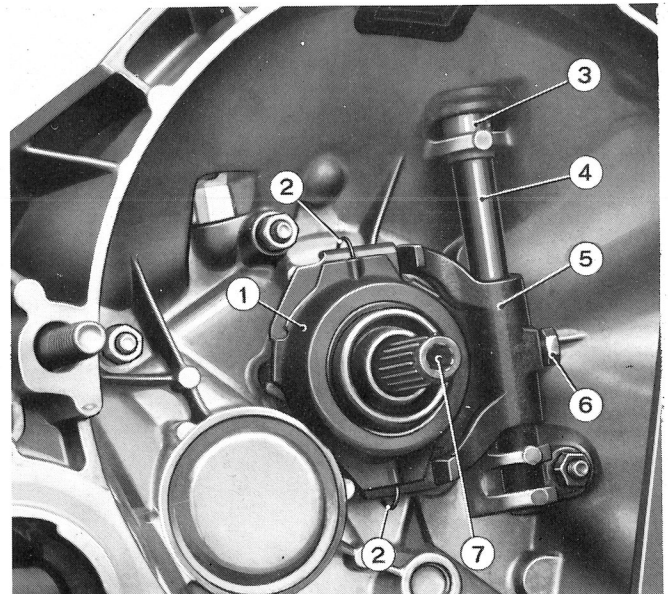
Installing circlip on mainshaft using round nose pliers



- fit the axle shafts into the differential and install the boots; then tie up the axle shafts to keep them from falling out.

Detail of clutch release control

1. Sleeve with bearing for clutch release — 2. Fork to sleeve union springs — 3. Bushing — 4. Shaft — 5. Clutch release control fork — 6. Fork to shaft screw — 7. Clutch shaft.

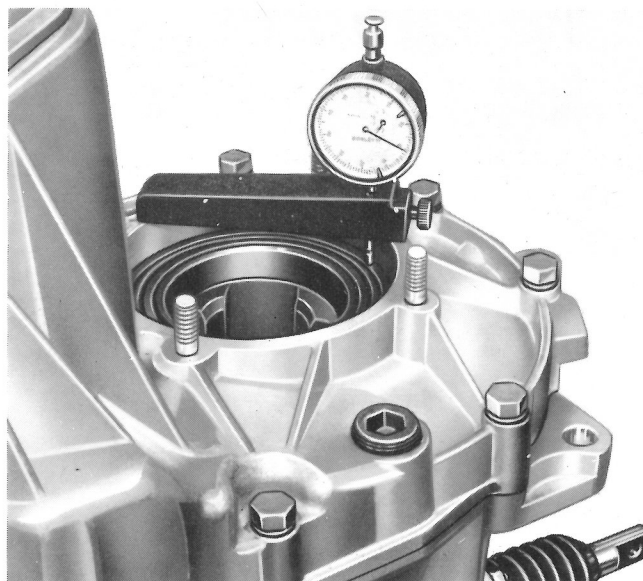


DIFFERENTIAL BEARING SETTING

The inner differential case bearings must be **pre-loaded**.

This is obtained by putting shims between the outer race of the bearing and the side cover; total thickness of the shim is determined as follows:

- settle the bearings by applying an axial load of about 770 Lbs (350 kg).
- set fixture **A. 95655** with dial indicator on the side cover mounting surface; set the dial finger against the outer race of the bearing and move the dial to zero;



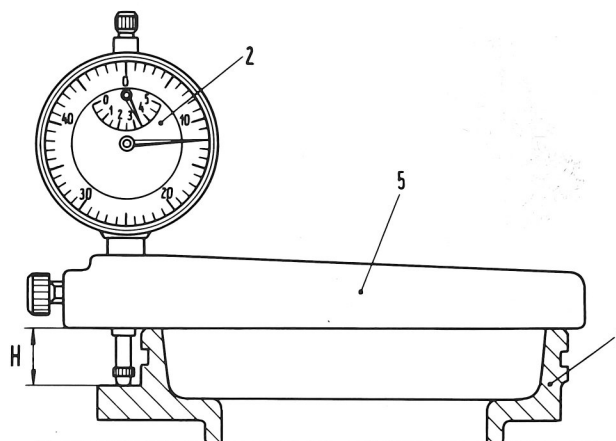
- with the dial zero-set as indicated, rest the fixture **A. 95655** on the side cover with the finger on the cover and case contact surface; the value shown by the dial corresponds to the difference between distance »P« and height »H«

This value, increased by .003 in. (0,08 mm) will give the total thickness of the shims to be put between cover and the outer race of the bearing.

The shim thickness is determined using the following formula:

$$S = P - H + .003 \text{ in. (0,08 mm)}$$

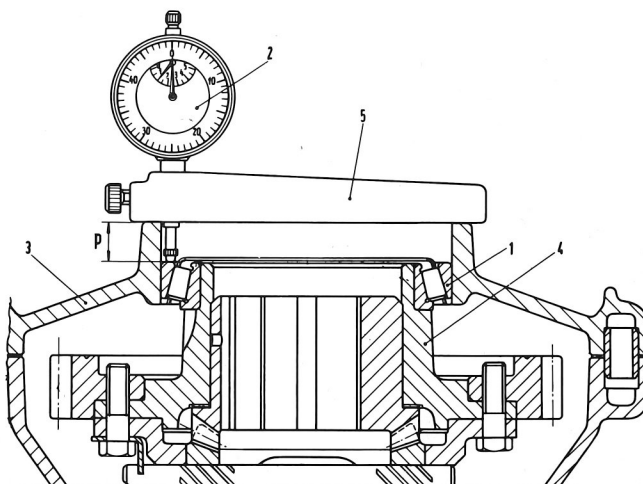
where »P« is the distance between the outer race of the bearing and the side cover mounting surface, and »H« is the height of the cover.



1. Roller bearing — 2. Dial indicator — 3. Transmission case — 4. Differential case — 5. Tool A. 95655 — 6. Side cover.

P = distance between cover mounting surface and outer race of bearing (1).

H = height of cover.

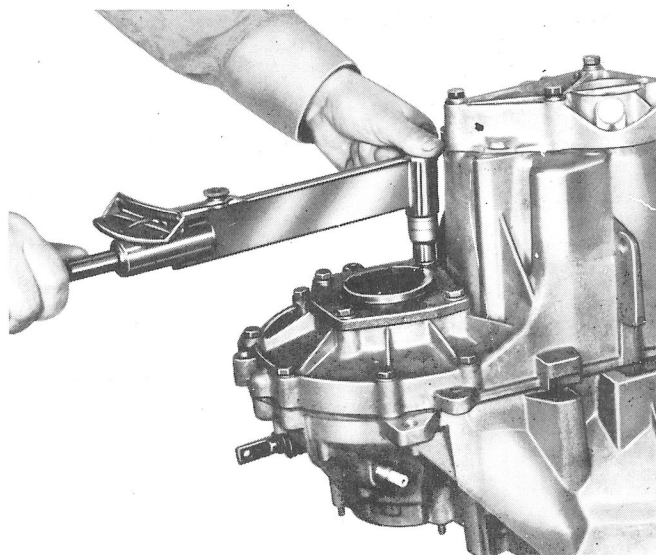


After determining the exact value of the shim, choose one from among those supplied for service whose thickness is as close as possible to this value.

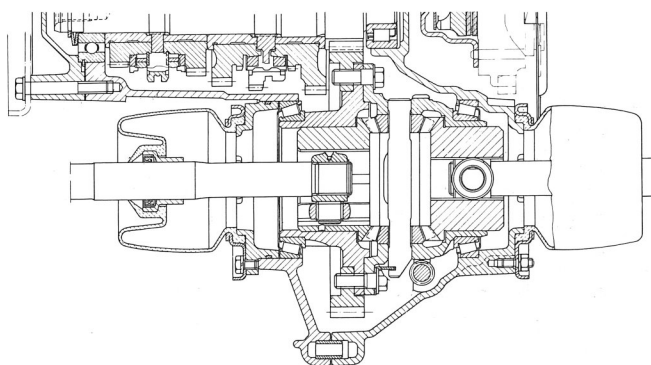
NOTE — Shims are supplied for service in the following thicknesses: .0196, .0236, .0275, .0315, .0354, .0394, .0433 in. (0,50, 0,60, 0,70, 0,80, 0,90, 1,00, 1,10 mm).

To prevent measurement errors, the contact surfaces of the shims should be thoroughly cleaned.

Place the shim on the bearing and install the cover, tightening the attaching nuts to a torque of 18.5 ft. lb. (25 Nm).



Longitudinal section through final drive unit

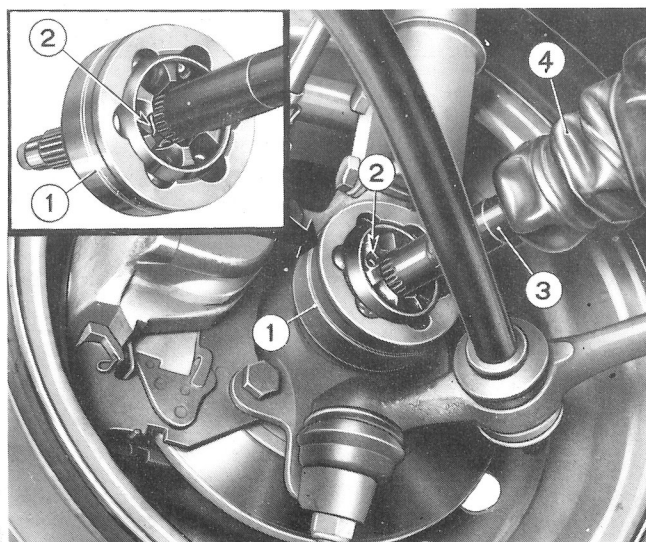


REMOVAL AND INSTALLATION OF AXLE SHAFTS

Where service operations require the removal of axle shaft units, proceed as follows:

- drain some oil from the transmission;
- unscrew the axle boot flange nuts and screws;
- remove the outer clamps on the constant — velocity joint boots and pull the boots (4) back along the axle shaft so as to completely uncover the joints;
- clean the grease off the joints;
- using pliers, open the snap ring on the joints (2) and take the shaft ends out of their seats in the joint;
- turn the car wheels to enable the shafts to be fully removed from their seats in the differential.

1. Constant velocity joint
2. Snap ring
3. Axle shaft
4. Boot



Replacing Axle Boot and Seal.

Remove the snap ring from the inner end of the axle and slide the tripod joint off its spline.

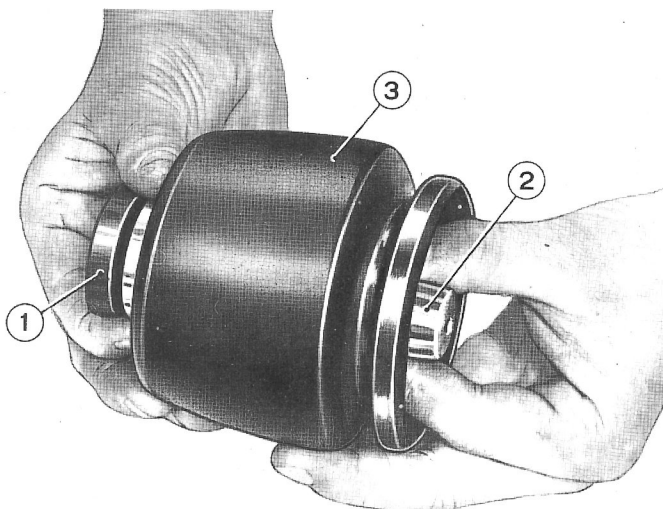
Remove the boot, bushing, and seal together.

Clean the polished surface of the axle with solvent and fine emery - paper as necessary to provide a proper sealing surface.

Replace the sealing parts as necessary.

Use tool A. 70375 to spread the boot and insert the bushing as shown. Install tool A. 70375 J over the end of the axle to avoid damage to the seal lip when sliding the boot onto the axle shaft.

1. Bushing — 2. Tool A. 70375 — 3. Boot.

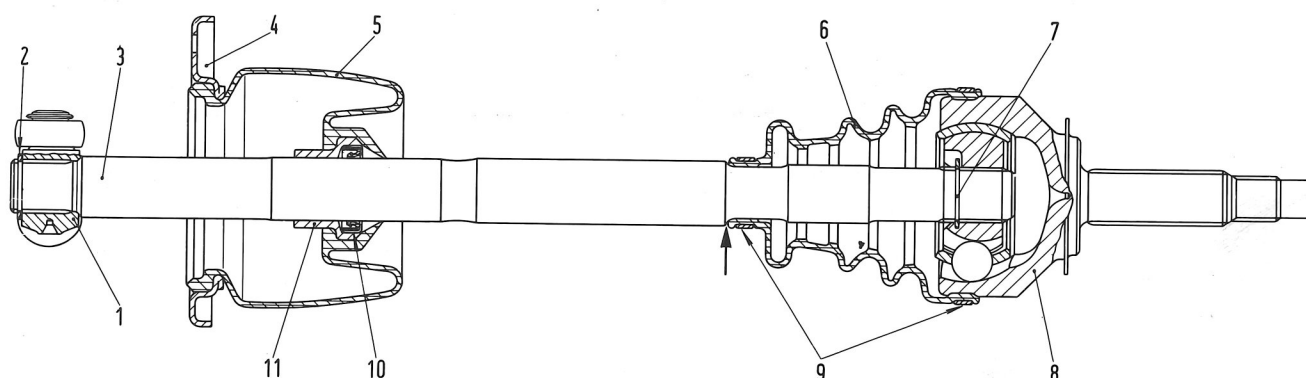
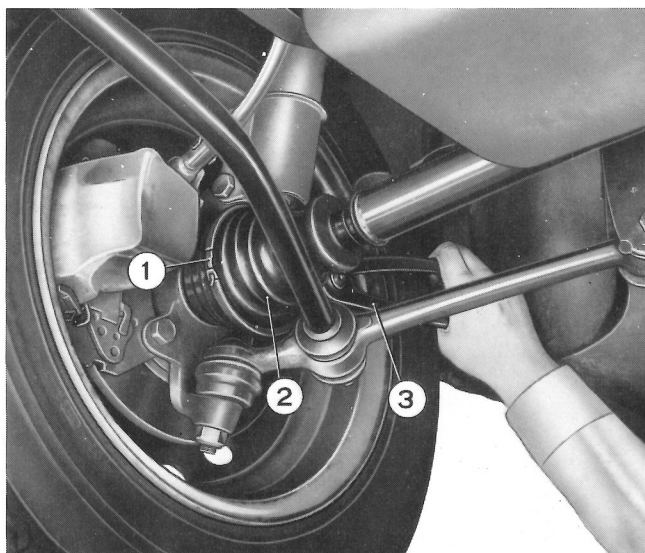


Reinstall the axle in reverse order of removal.

NOTE — To make sure the axle shaft snap ring is in fact lying in its groove, move the shaft inwards and outwards a few times; this operation is important as correct ring setting is vital.

Axle boot clamps using pliers A. 81118.

1. Outer clamp
2. Boot
3. Tool A. 81118



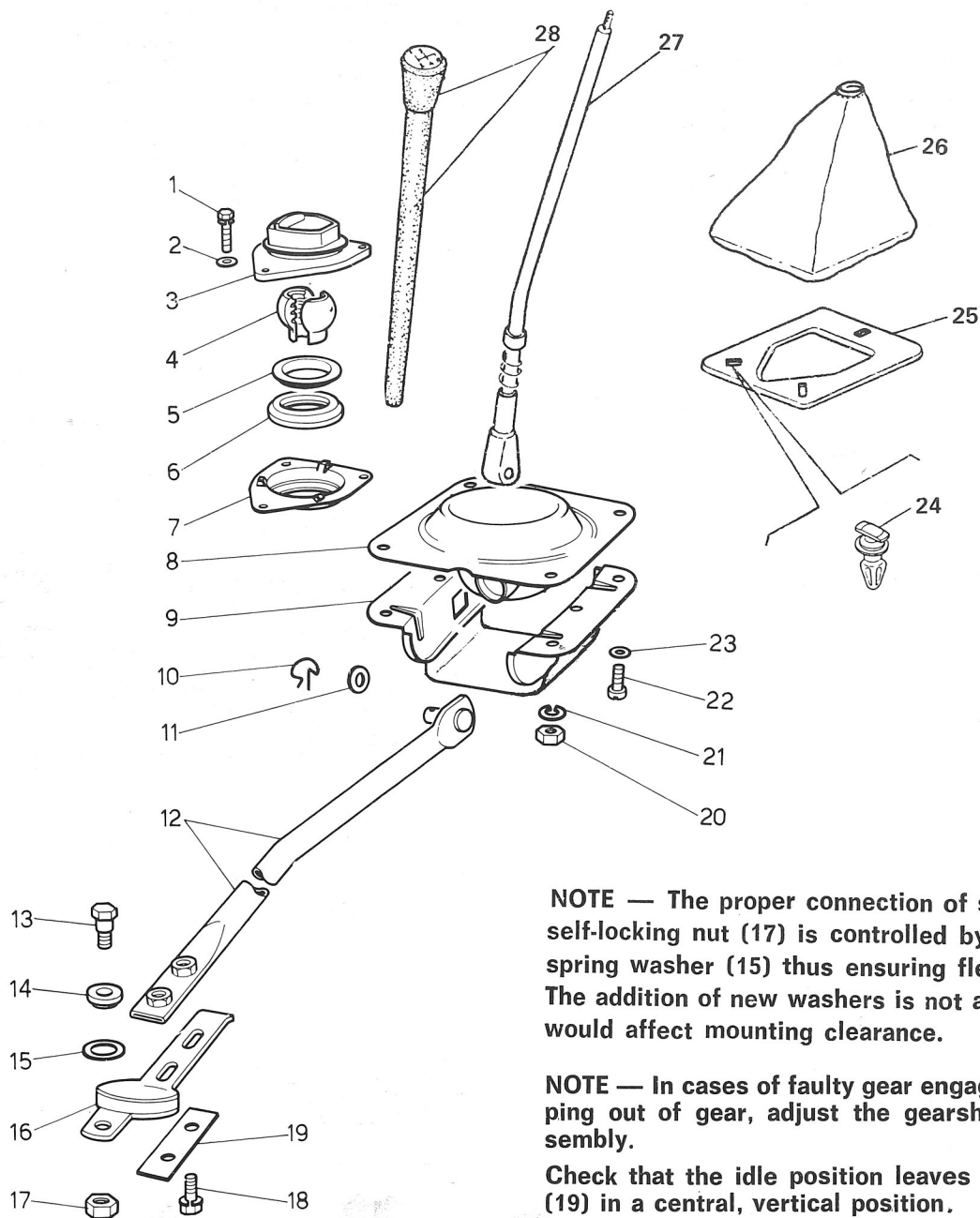
- | | | |
|-----------------|----------------------------|------------------|
| 1. Tripod joint | 5. Axle boot | 9. Boot clamps |
| 2. Circlip | 6. CV joint boot | 10. Axle seal |
| 3. Axle shaft | 7. Snap ring | 11. Seal Bushing |
| 4. Flange | 8. Constant velocity joint | |

The arrow indicates the shoulder which the boot (6) should contact after installation.

— Lubricate the constant velocity joint sockets and the protective boot using lithium base grease. Use 3 ozs. (0,95 kg) of grease to each joint.

REMOVAL AND INSTALLATION

Inside the car, slide the shift lever boot up the lever and remove the clips holding the boot base. Remove three bolts (1) holding the shift gate; remove the lever and pivot assembly by lifting it.



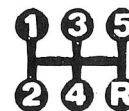
NOTE — In cases of faulty gear engagement or slipping out of gear, adjust the gearshift control assembly.

Check that the idle position leaves the gear lever (19) in a central, vertical position.

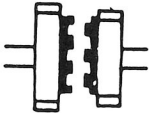

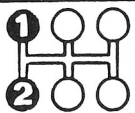

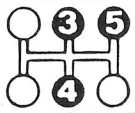


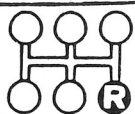

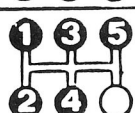

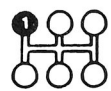
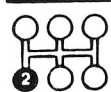
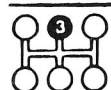
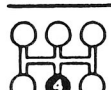
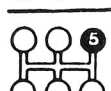

To adjust, slacken screws (18) and shift the flexible rod (16) in the elongated holes.

- | | | | |
|------------------------------|---------------------------|-------------------|----------------------|
| 1. Screw | 8. Guard with rubber boot | 15. Spring washer | 22. Bolt |
| 2. Flat washer | 9. Bottom guard | 16. Flexible link | 23. Flat washer |
| 3. Shift gate | 10. Cotter pin | 17. Nut | 24. Clip |
| 4. Spherical ball | 11. Flat washer | 18. Bolt | 25. Boot base |
| 5. Spherical ball lower part | 12. Shift tube | 19. Plate | 26. Shift lever boot |
| 6. Lower ring | 13. Screw | 20. Nut | 27. Shift lever |
| 7. Support | 14. Ring | 21. Lock washer | 28. Shift knob |




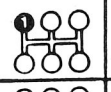
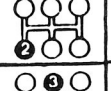
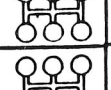
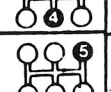
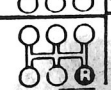

SPECIFICATIONS



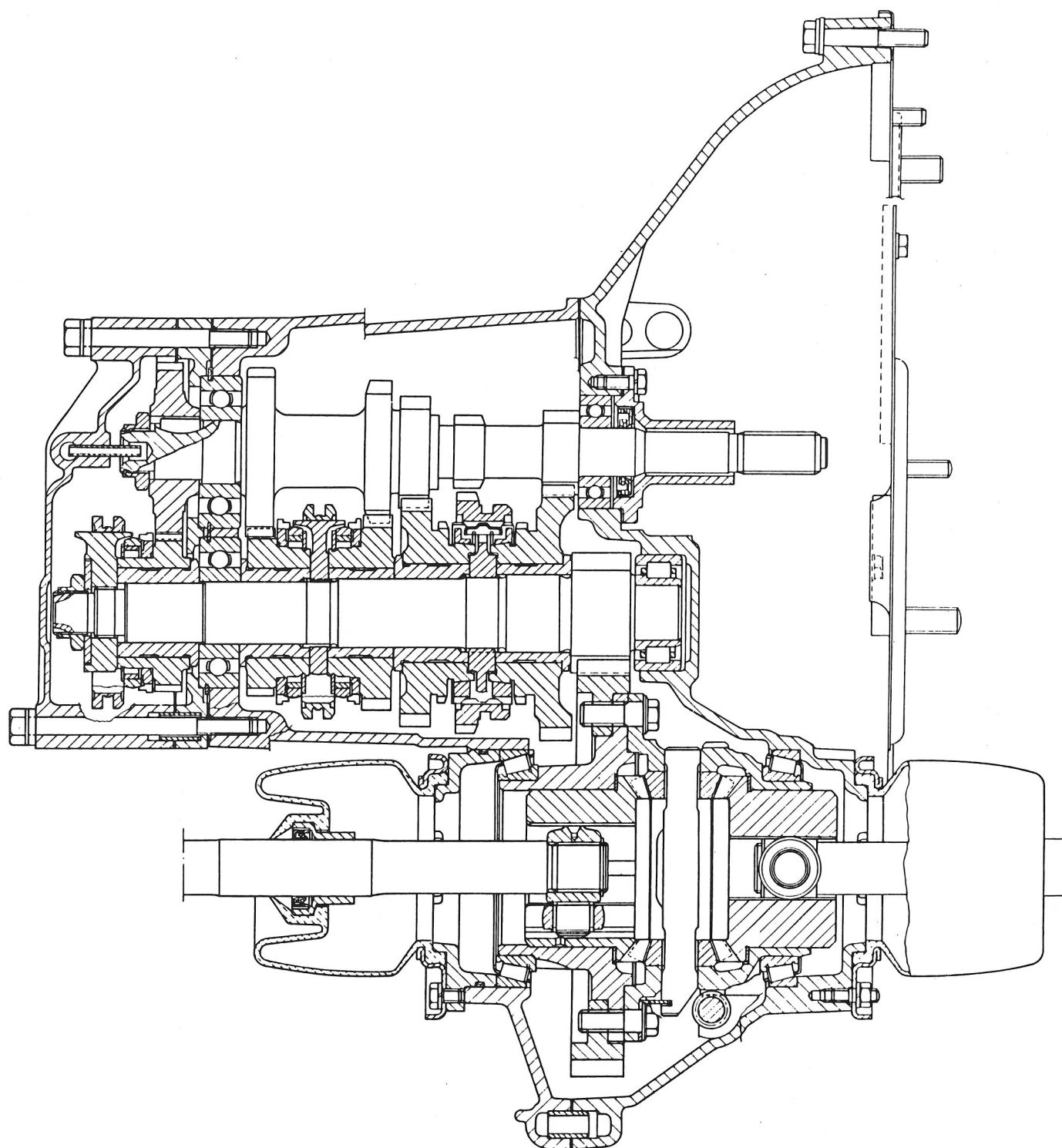
GEARBOX

 SYNCHRONIZERS	BORG-WARNER TYPE SYNCHRONIZER 	
	PORSCHE TYPE SYNCHRONIZER 	
 GEARS	STRAIGHT TEETH 	
	HELICOIDAL TEETH 	
 DRIVE RATIO		4,09
		2,235
		1,469
		1,403
		0,862
		3,714

DIFFERENTIAL

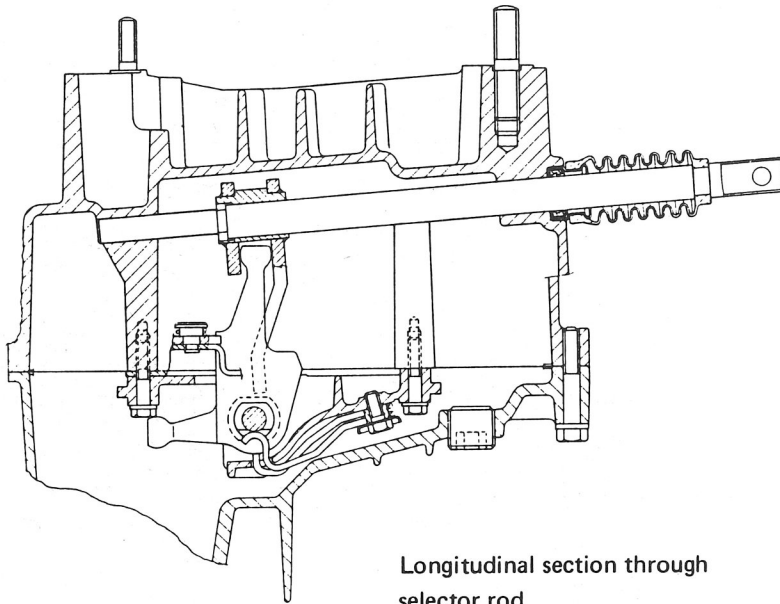
 REDUCTION DRIVE RATIO		3,76
 OVERALL REDUCTION RATIO		15,37
		8,38
		5,52
		3,92
		3,24
		13,95

LONGITUDINAL SECTION THROUGH 5 SPEED TRANSMISSION

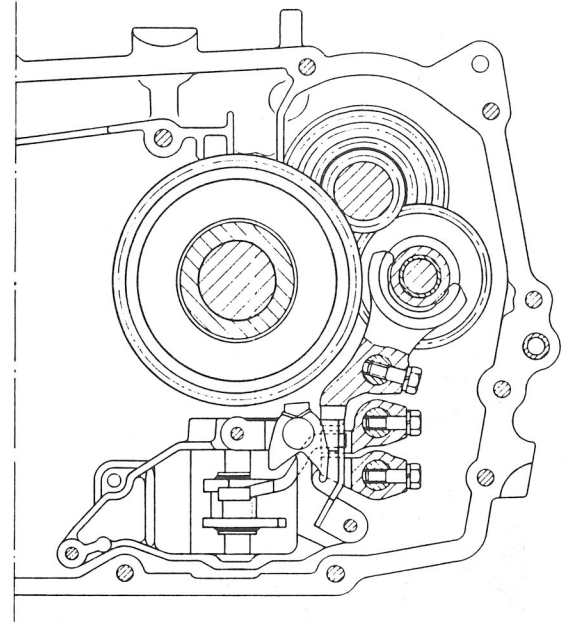


Longitudinal section through five speed transmission-differential

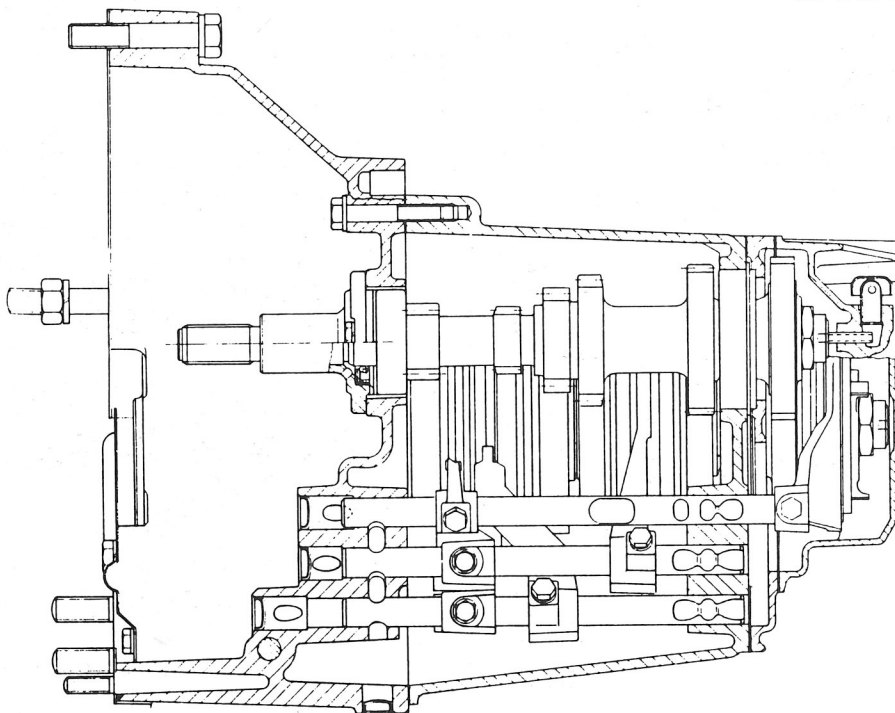
SECTIONS OF FIVE SPEED TRANSMISSIONS



Longitudinal section through
selector rod



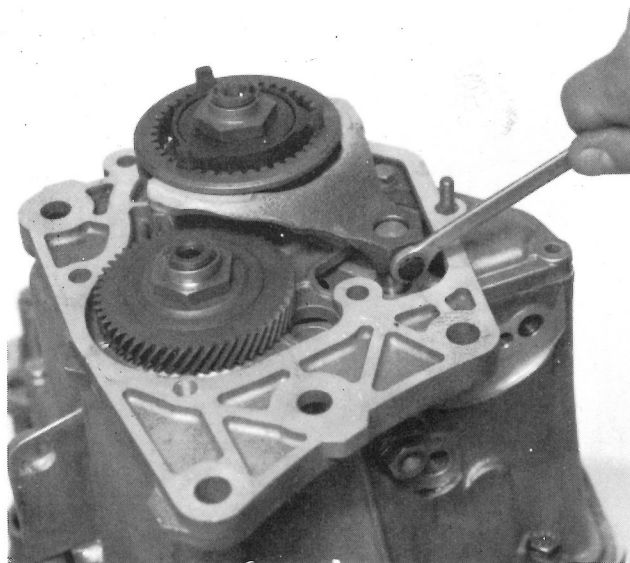
Section through the control tooth for
the selection of fifth and reverse gear



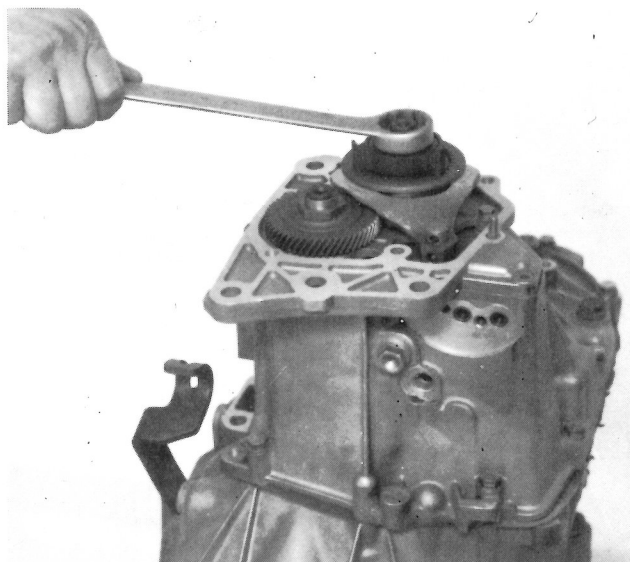
Cross section of the selector rod and forks

DISASSEMBLY ON THE BANCH

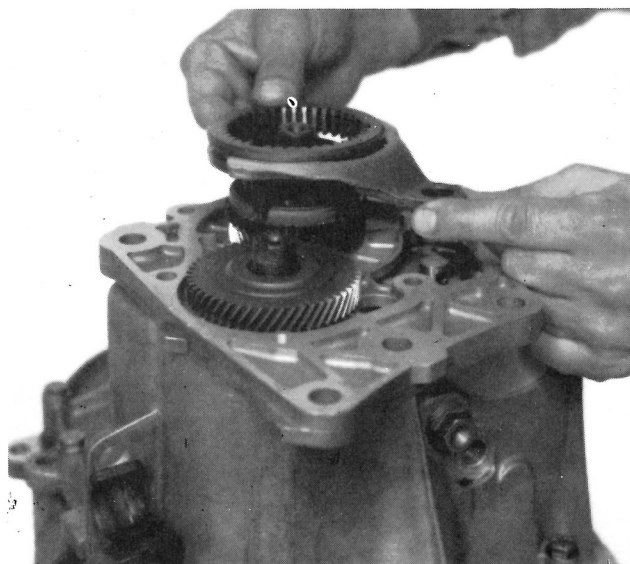
Disassembly of retaining bolts for the 5th gear shift fork



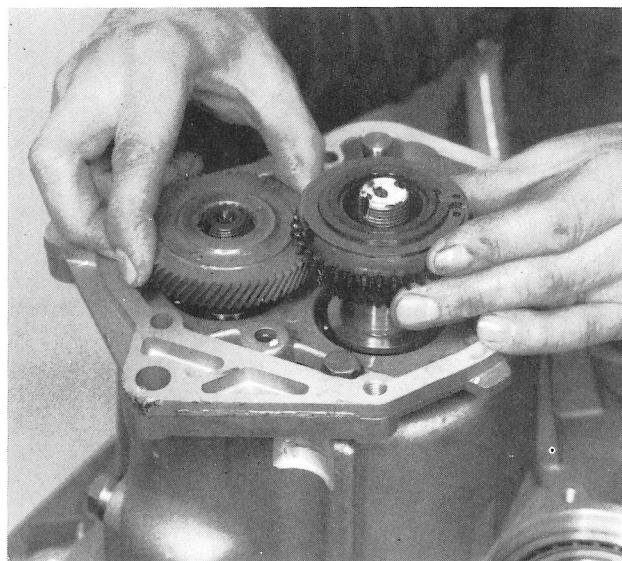
Disassembly of ring nut for the 5th gear fixing



Disassembly of hubs, forks and sleeves for the 5th gear

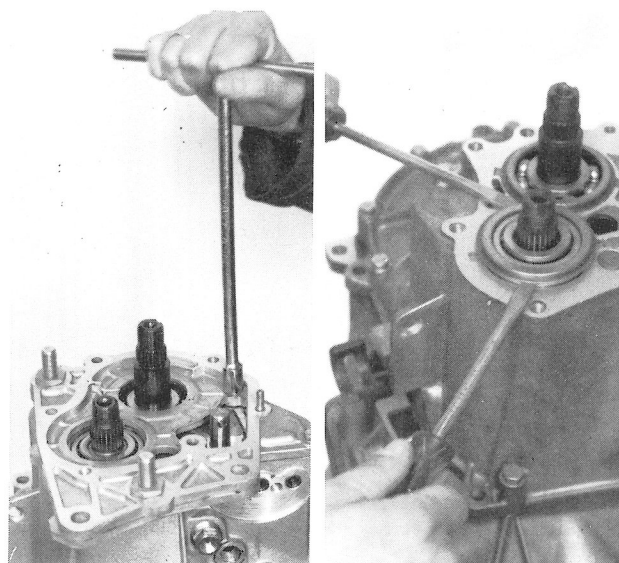


Disassembly of the 5th gear

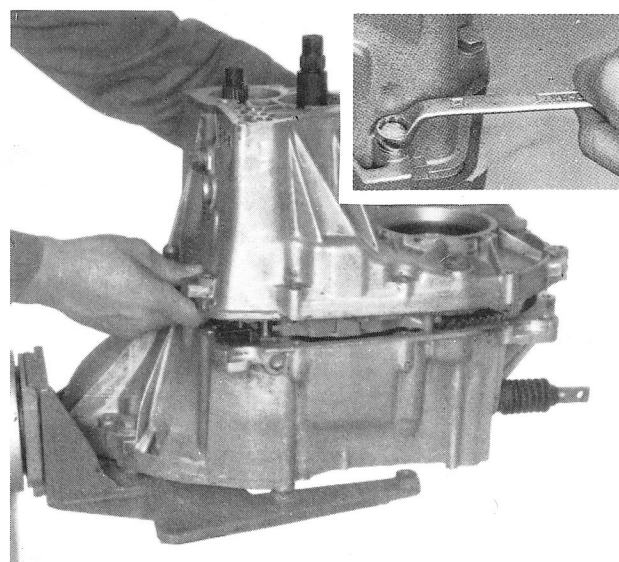


Disassembly of medium cover and rear bearings from the mainshaft and countershaft

NOTE: Bearings must be replaced whenever scratch, bigger clearance or wearing appears.



Disassembly of gear box

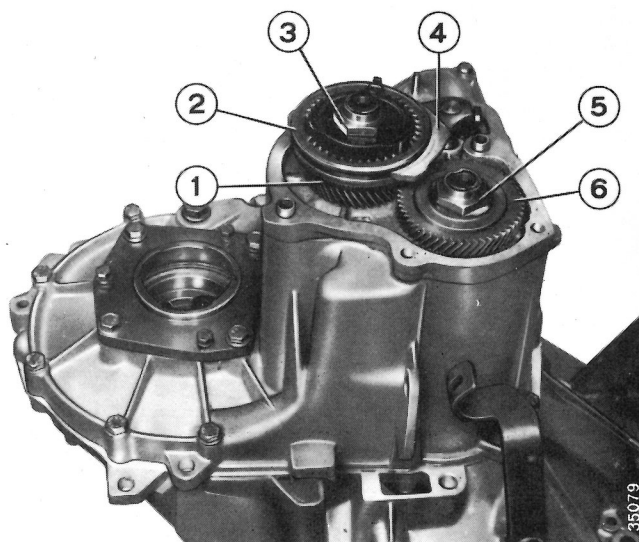


REPAIR OF FIVE-SPEED TRANSMISSION

Parts of the 5th gear, installed in transmission

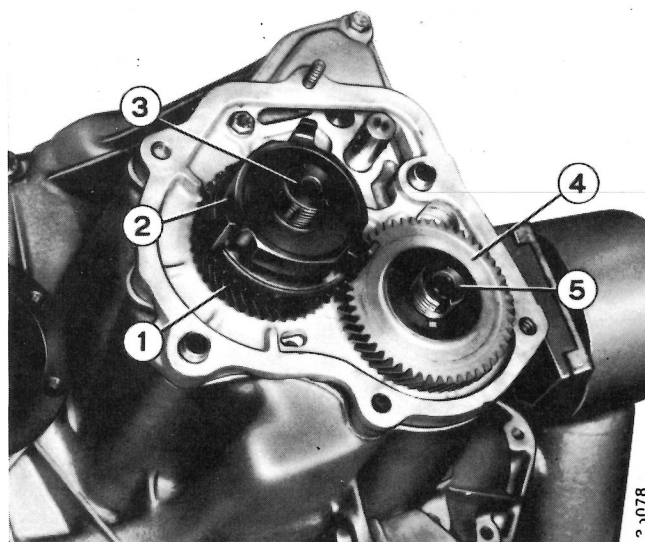
1. Pinion — 5th gear
2. Sliding sleeve for fifth gear selection
3. Pinion retaining ring
4. Fork — 5th gear
5. Gear retaining ring
6. 5th gear

Synchronizer of the fifth gear is with flexible ring. Rings for gear and pinion retaining should be deformed after installation. For that reason, they should be replaced after each disassembly.



Parts of the 5th gear

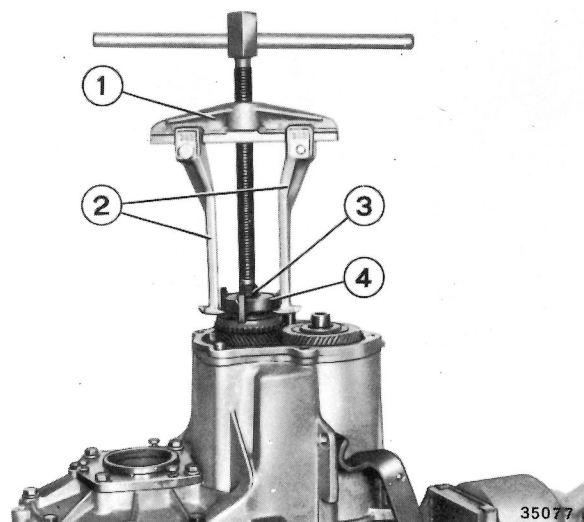
1. Pinion — 5th gear
2. Sliding sleeve hub
3. Auxiliary shaft
4. 5th gear
5. Mainshaft

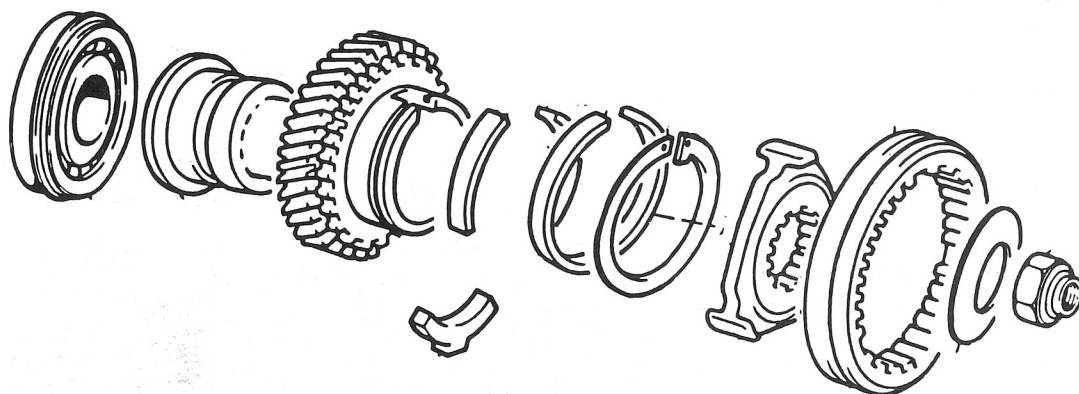


Disassembly of the sliding sleeve hub — 5th gear

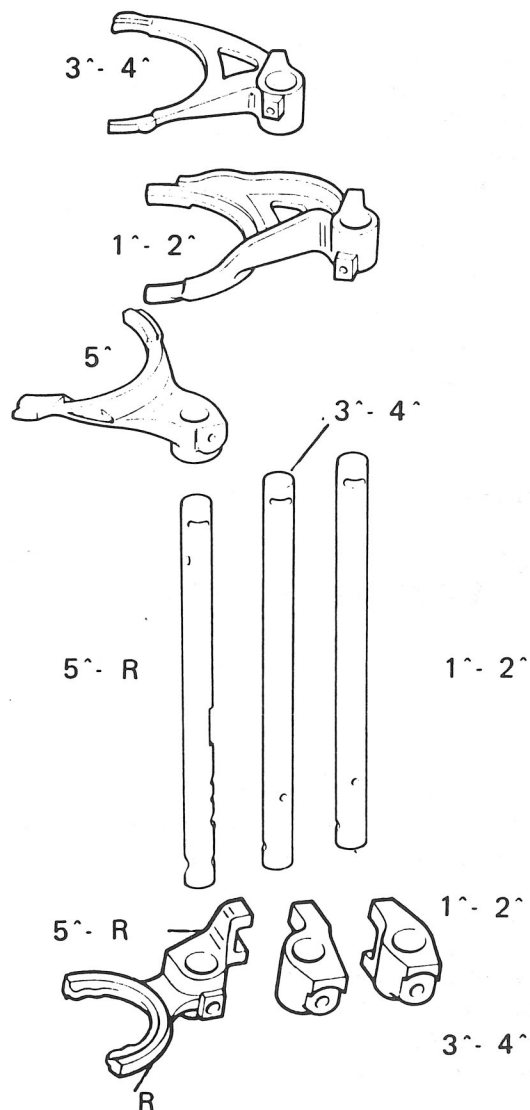
Sliding sleeve hub of the 5th gear is removed by universal puller A.40005/002 and levers A.40005/302

1. Universal puller A.40005/002
2. Puller levers A.40005/302
3. Auxiliary shaft
4. Sliding sleeve hub



Exploded view of 5th gear**Dog inspection**

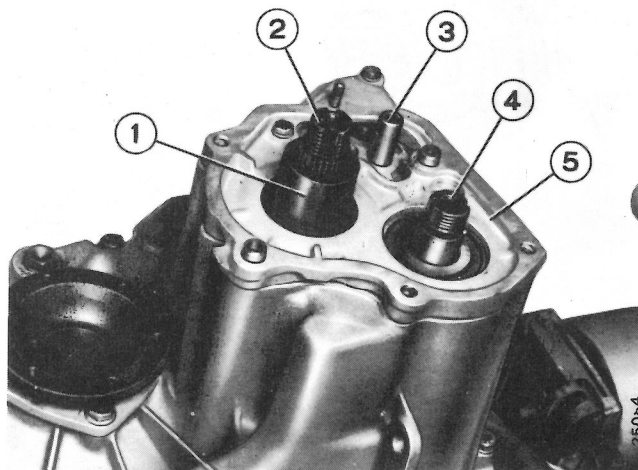
Dogs must not have the signs of deformation or wearing in locking ball seats. They must slide easily in their seats.

**Fork inspection**

Forks must not be deformed; wearing signs must not appear on the surfaces in contact with sliding sleeves.

Upside view

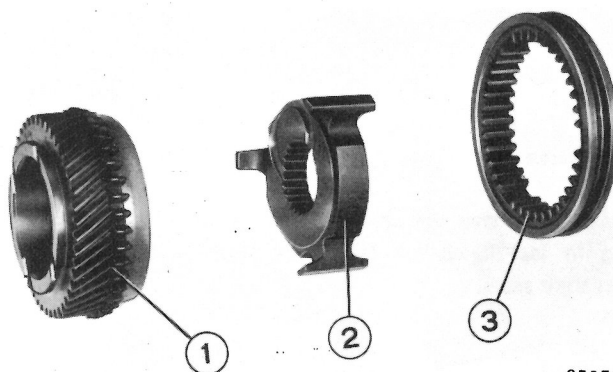
1. Pinion bush — 5th gear
2. Auxiliary shaft
3. 5th gear and reverse shaft
4. Main shaft
5. Medium cover



On the sliding sleeve hub there is a groove for oil recycling; during assembly groove must be turned towards 5th gear pinion.

Gear mash

1. 5th pinion
2. Sliding sleeve hub
3. 5th gear sliding sleeve



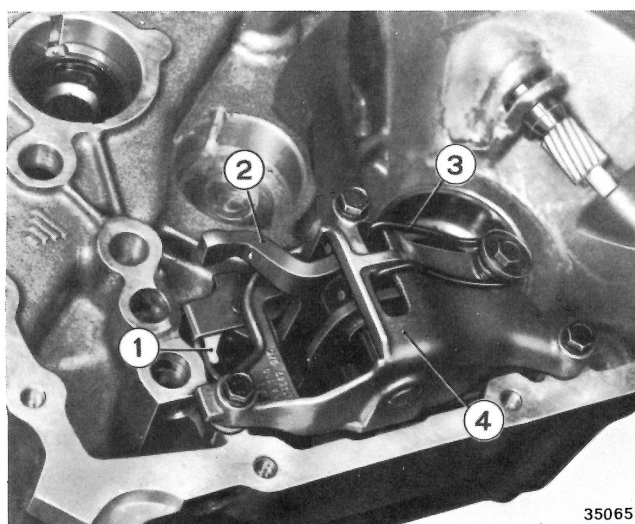
35071

Support of the gear selector rod

When 5th gear is selected bottom part of the selector rod doesn't act upon the tooth (1) which stays stationary.

Reverse cannot be shifted from the 5th gear. Bottom part of the shaft (2) is blocked by tooth (1), thus disabling engagement of reverse gear.

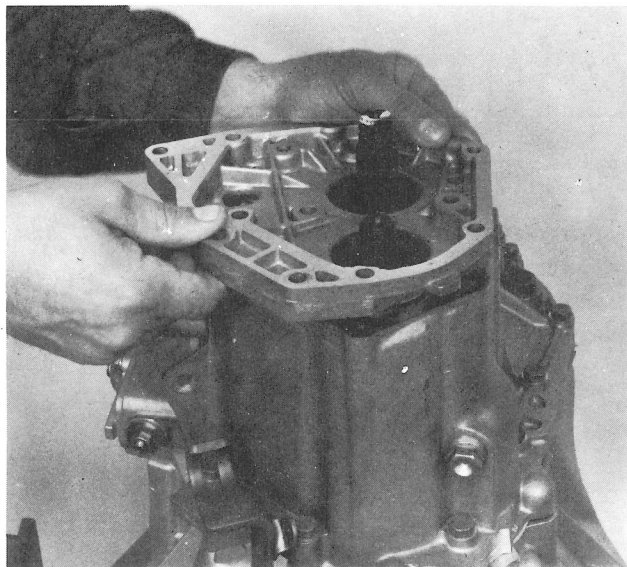
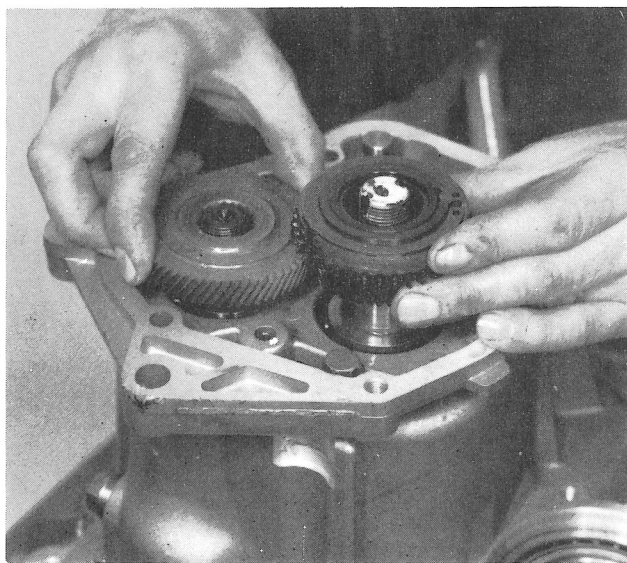
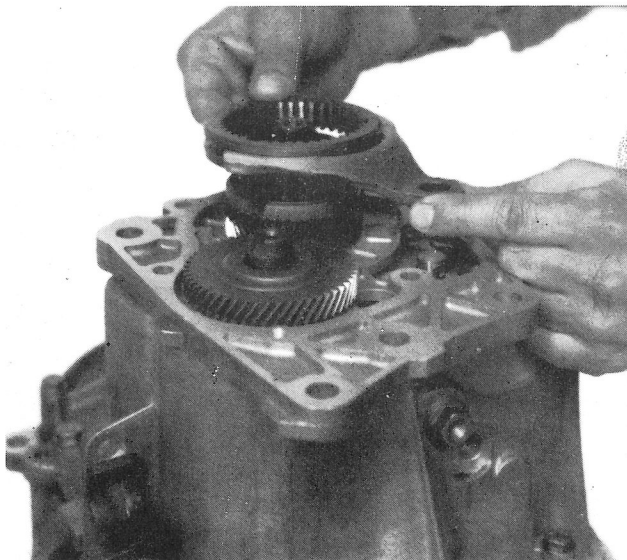
1. Control tooth — reverse gear
2. Selector rod (when 5th gear is engaged)
3. Return spring rod (2)
4. Support



35065

ASSEMBLY

Assembly of medium differential

Assembly of the 5th gearAssembly of hubs, forks and sleeves for the 5th gear

Tightening of ring nut for the 5th gear

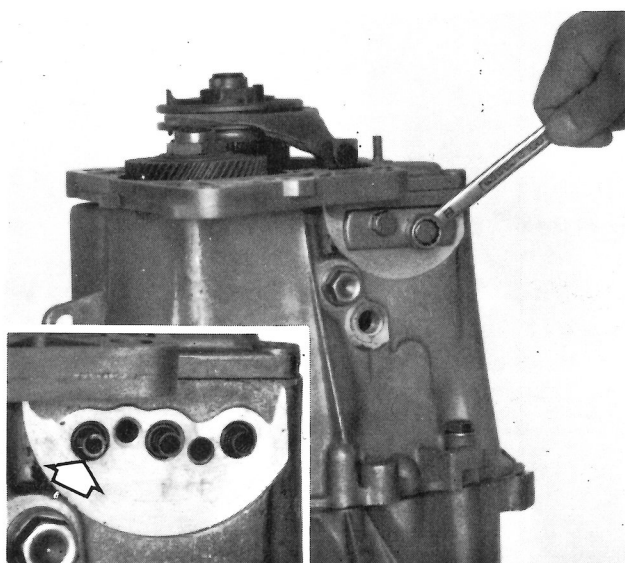
NOTE: Gear ring nuts should be deformed after assembly.

Any time after disassembly, gear ring nuts be replaced.

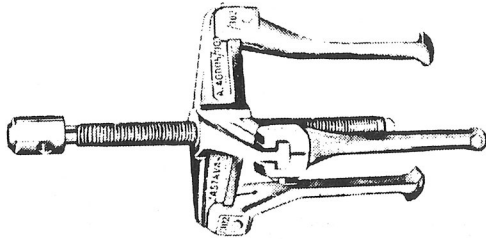


Assembly of balls and springs for mounting of gearshift lever

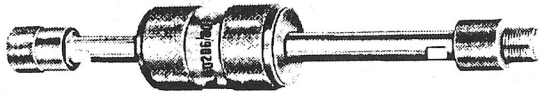
Arrow shows a longer diameter of spring mounted on the basis of 5th and reverse gear control.



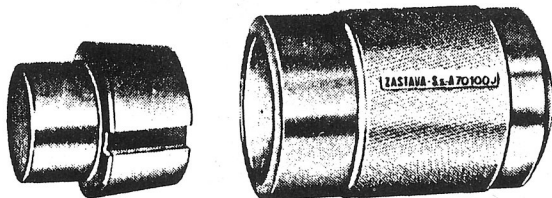
SERVICE TOOLS



A. 40005/003 Three-legged tool, inner ring bearing removal from differential case (complete with 3 jaws A. 40005/302).



A. 40206 Slide hammer puller (to be used with special tools).



A. 70100j (3° - 4°)

A. 70100 (5°)

Tool, transmission synchronizer snap rings installation.



A. 70284 Remover and installer, shaft snap ring and Belleville washers.

(Use on press without central bolt)



A. 70296 Driver, gear selection rod seal installation



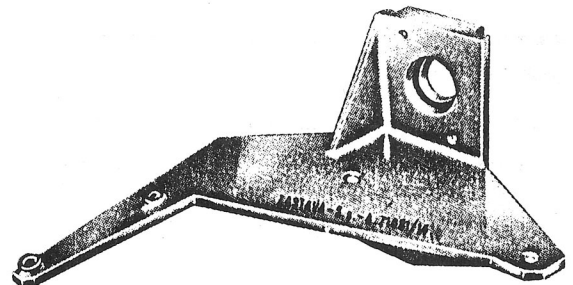
A. 70301 Installer socket gear selection rod seal



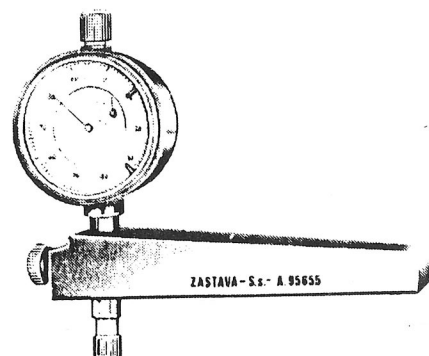
A. 70375 Tool, for assembling the seal and lock ring bushing on the differential boots



A. 70375 J Tool, axle shaft oil seal installation.



A. 71001/14 Support, gearbox and differential unit during overhaul (to be mounted on revolving stand (A. 61000 or support column A. 71000).



A. 95655 Jig with dial gauge for differential bearing adjustment.

Done

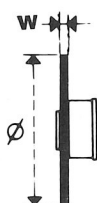



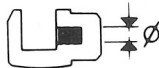
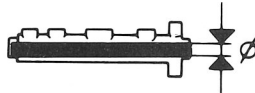
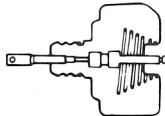
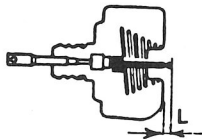
BRAKES

BRAKES

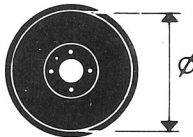


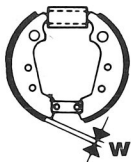
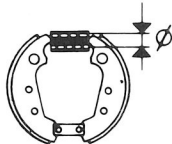
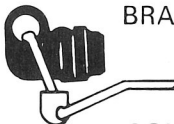

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SPECIFICATIONS

FRONT BRAKES

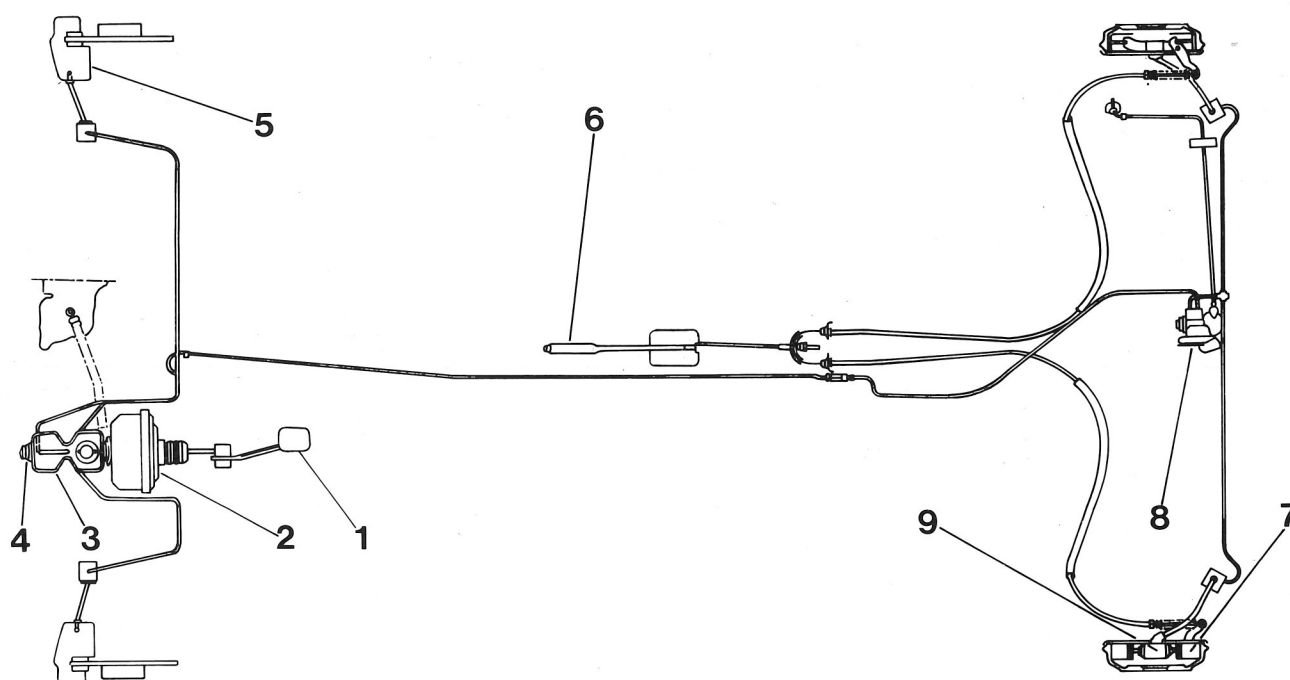
	DISC		Ø	in	mm	
				8.937	227	
				NEW	.421 — .429	10,70 — 10,90
					.368	9,35
	WEAR <			.354	9	
	FRICTION LINING		WEAR <	.059	1,5	
	CALIPERS		Ø	1.889	48	
	MASTER CYLINDER		Ø	3/4	19,05	
	BOOSTER UNIT	VACUUM DEVICE WHICH INCREASES BRAKE PEDAL PRESSURE				
	DISTANCE BETWEEN PUSHROD AND BODY AT REST			.032 — .040	0,825 — 1,025	

REAR BRAKES

	DRUM		NEW	7.293 — 7.304	185,24 — 185,53
				7.336	186,33
			WEAR >	7.336	186,33
	SHOE		WEAR <	.059	1,5
	CYLINDER		Ø	3/4	19,05
	BRAKE PRESSURE COMPENSATOR			ACTING TO REAR WHEEL	
	COMPENSATOR LINK SETTING				
				2.362 ± .199	60 ± 5

TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Torque		
		Ft. Lb.	Kgm	Nm
Master cylinder mounting nut	M 8	18,5	2,5	25
Brake booster mounting nut	M 8	11,1	1,5	15
Caliper flex line fitting	—	20	2,8	27
Wheel cylinder flex line fitting	M 10 x 1,5	14	2	20
Rear brake compensator bolt	M 8	18,5	2,5	25
Hand brake lever mounting bolt	M 8	11,1	1,5	15



Brake system diagram

- | | |
|--------------------------|-------------------------------|
| 1. Brake pedal | 6. Hand brake lever |
| 2. Booster | 7. Brake shoe |
| 3. Brake fluid reservoir | 8. Brake pressure compensator |
| 4. Master cylinder | 9. Wheel cylinder |
| 5. Disc brake caliper | |

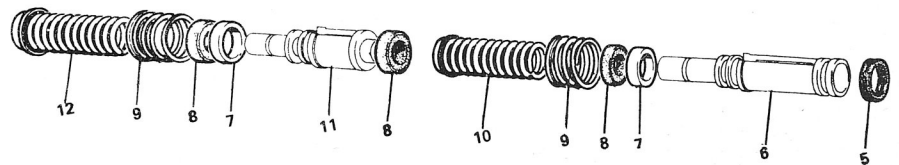
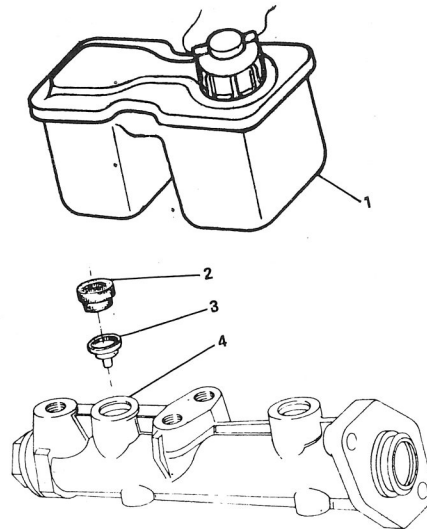
MASTER CYLINDER OVERHAUL

Remove two connectors (1) and seals (2) and plug (3).

Remove remaining internal parts (items 5 through 12) from cylinder (4).

Carefully inspect cylinder bore and piston surfaces. They should have a mirror-like finish without any kind of roughness. The cylinder bore can be honed to prevent leaks or excessive wear of seals and pistons. Do not increase size of bore. Replace seals and dustcovers. Clean all parts with denatured alcohol and lubricate with brake fluid. Reassemble in reverse order of disassembly.

1. Reservoir
2. Seal
3. Plug
4. Cylinder body
5. Seal
6. Rear piston
7. Bushing
8. Seal
9. Spring and cup
10. Spring
11. Front piston
12. Spring



FRONT BRAKES

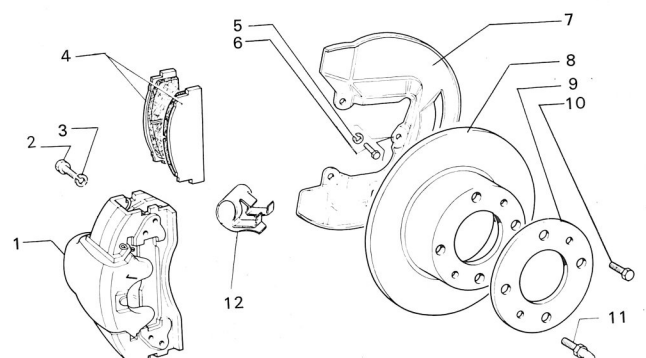
Exploded view of master cylinder

Before carrying out any maintenance operations, the brakes must be thoroughly cleaned, using only hot water and compressed air.

A similar procedure should be followed any time the car is being washed.

Details of front brake caliper and bracket

- | | |
|------------------|-----------------------------------|
| 1. Caliper brake | 7. Protection brake disc |
| 2. Bolt | 8. Brake disk |
| 3. Spring washer | 9. Plate brake disc |
| 4. Brake pads | 10. Screw - Brake Disc Back Plate |
| 5. Spring washer | 11. Stud - Wheel/Locating |
| 6. Bolt | 12. Caliper Locking block |



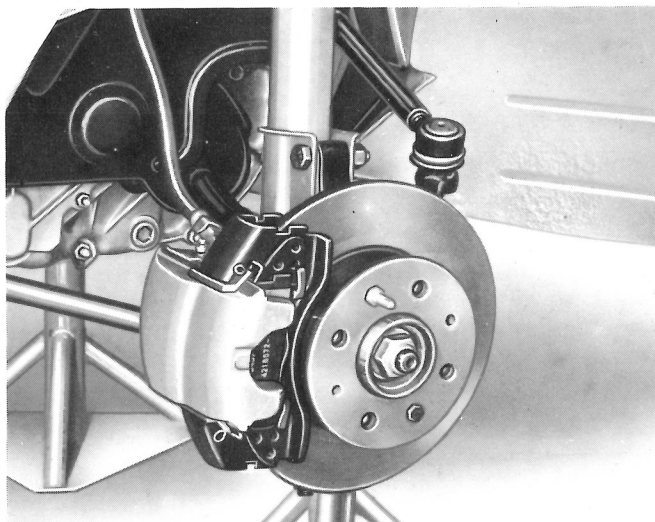
REPLACING FRONT WHEEL BRAKE PADS

REMOVING CALIPERS

Jack up the car, set it on stands and remove the wheels.

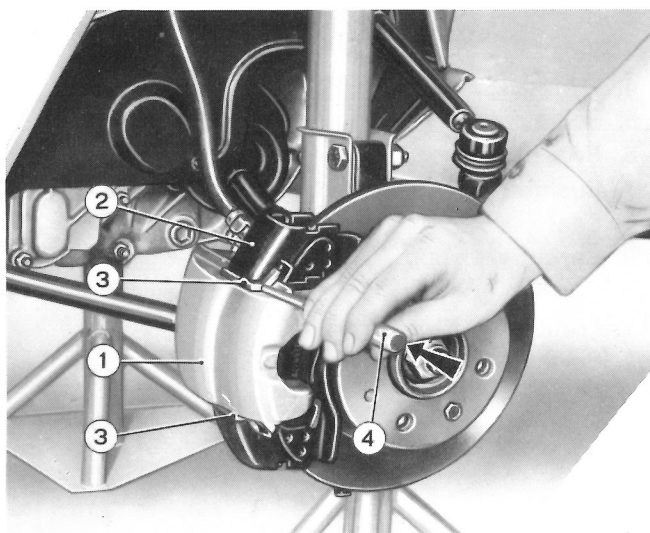
Plug the outlet ports in the brake fluid reservoir to prevent fluid escaping during the following operations.

Disconnect the brake hose from the caliper.



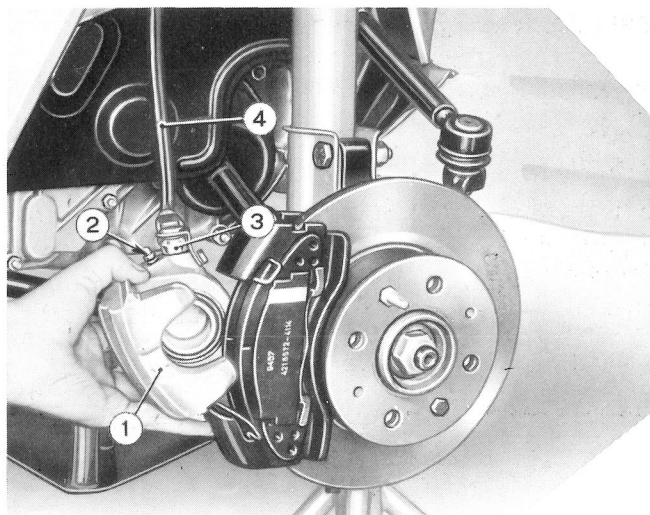
Take out caliper blocks as shown.

1. Caliper body
2. Caliper support bracket
3. Caliper locking blocks
4. Locking block remover

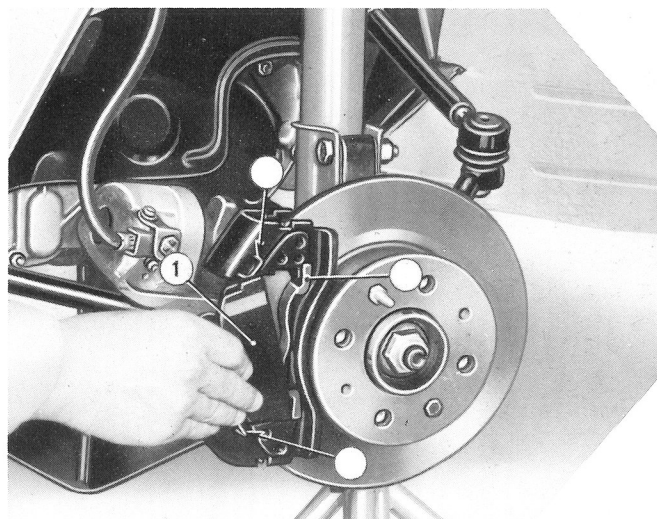


Remove the caliper and brake pads

1. Caliper body
2. Bleed screw
3. Connector
4. Flex line

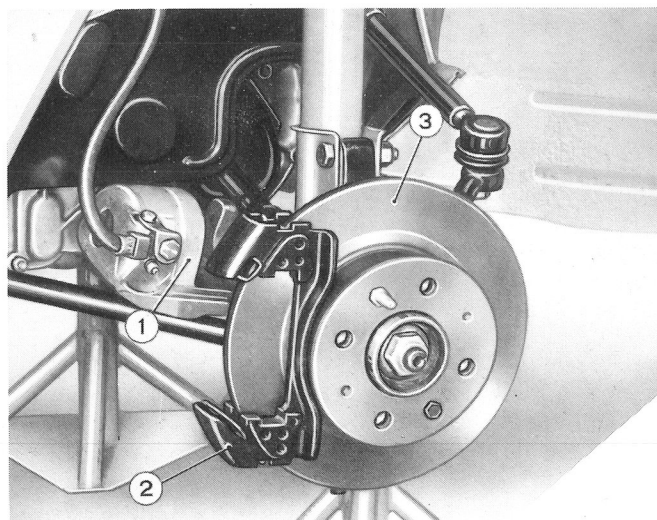


1. Brake pad



NOTE: Brake pads should be replaced when the lining material has worn down to .059 in. (1,5 mm).

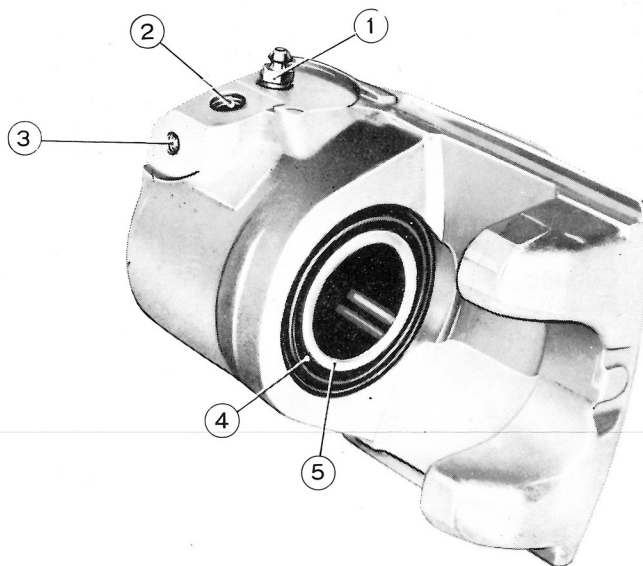
1. Caliper body
2. Caliper support bracket
3. Brake disc



DISASSEMBLING CALIPERS

To disassemble brake calipers on the bench, remove dust boot.

1. Bleed screw
2. Connector port of flex line
3. Locking plate screw hole
4. Piston dust boot
5. Piston

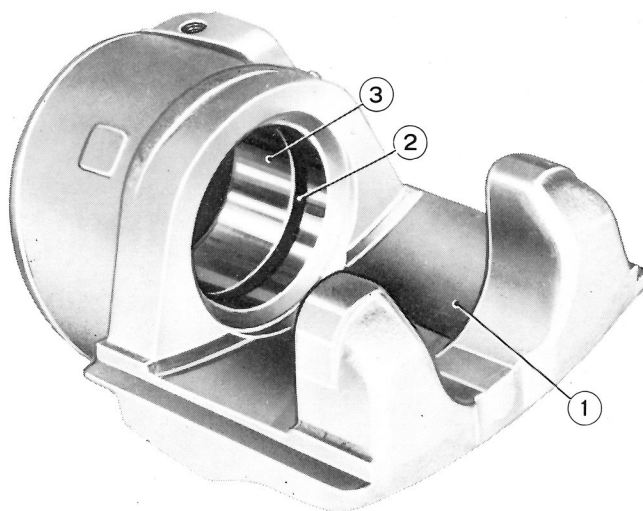


Blow out piston (5) from caliper cylinder directing a jet of compressed air into the fluid inlet.

Now remove seal, wash all the parts in hot water and blow them dry with compressed air. Then carefully inspect all parts for damage.

Check piston, as well as caliper cylinder, for signs of scoring or binding. If any are detected, the caliper and piston assembly must be replaced.

1. Caliper body
2. Seal
3. Piston bore



ASSEMBLING CALIPERS

After necessary inspections and replacements have been carried out, reassemble the brake calipers as follows.

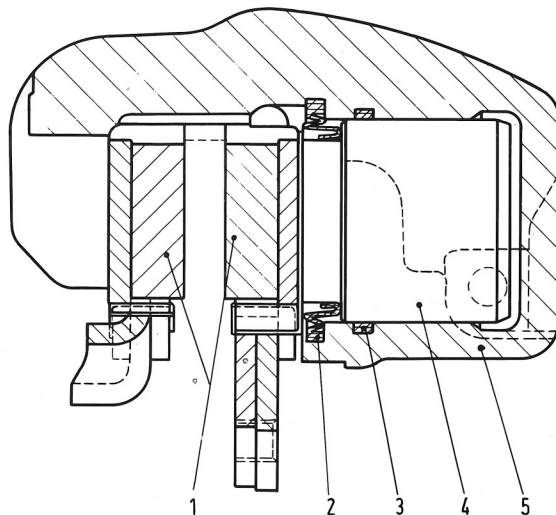
Lubricate all parts with DOT 3 brake fluid.

Install piston rubber seal into seat in caliper cylinder.

Insert piston all the way into the cylinder.

Install dust boot (2), making sure that the boot edge is well seated in the groove cut in caliper body.

1. Brake pads
2. Dust boot
3. Seal
4. Piston
5. Caliper body



Without removing the brake disc from the car, check that it runs true in rotation axis.

The maximum run-out shown by a dial indicator set .080 in. (2 mm) from the edge of disc, should be .006 in. (0,15 mm). Otherwise reface the disc and measure its resulting thickness which must not be less than .368 in. (9,35 mm).

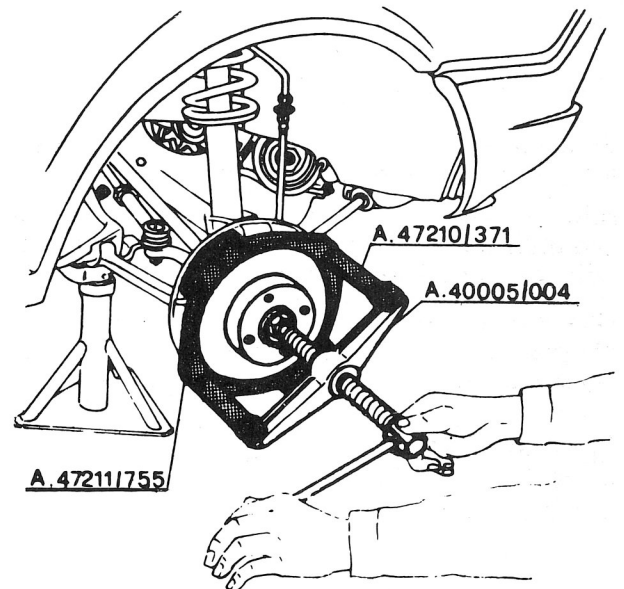
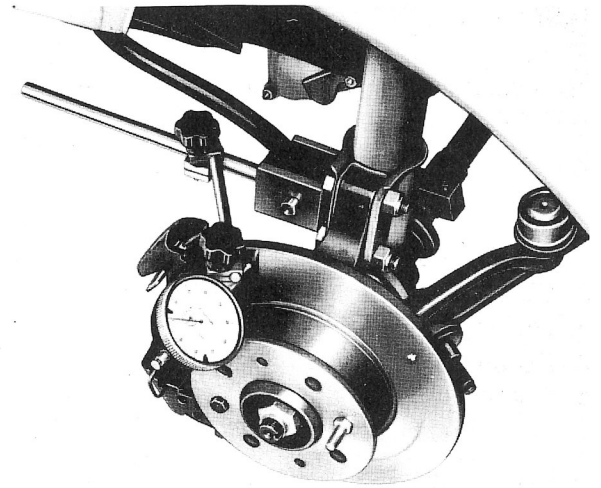
If there is any damage or scoring on the disc surface, or excessive wear, the disc assembly must be replaced. Minimum allowable thickness from wear is .354 in. (9 mm).

Maximum permissible run-out, read on dial indicator, .006 in. (0,15 mm).

BRAKE DISC REMOVAL

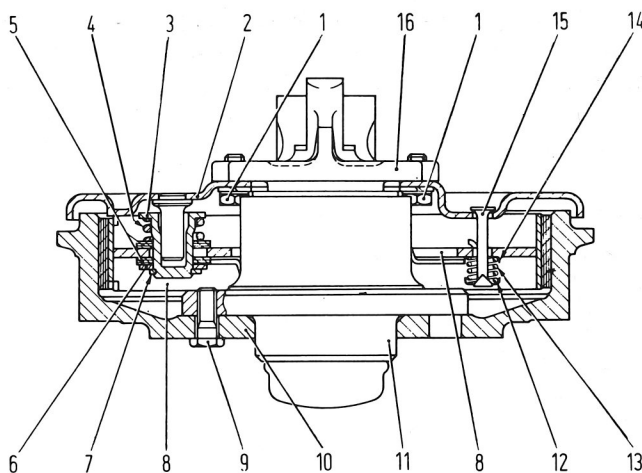
Remove the retaining bolt and locator pin, and remove the plate. Attach puller ring halves A. 47211/775 to the disc. Then assemble legs A. 47210/371 onto yoke A. 40005/004. Insert the legs into the recesses of the puller ring and center the puller yoke on the spindle.

Turn the bolt and pull the disc loose.



REAR BRAKES

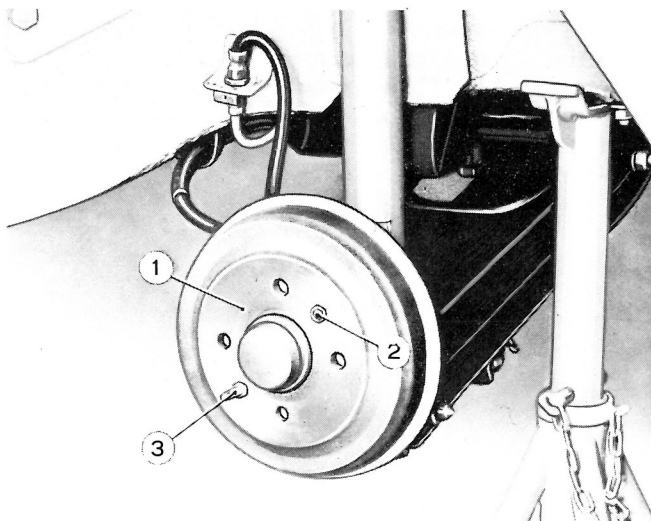
1. Backing plate bolt
2. Backing plate
3. Self-adjuster bushing
4. Self-adjuster spring
5. Friction washers
6. Flat washer
7. Snap ring
8. Brake shoes and linings
9. Drum attaching screw
10. Brake drum
11. Hub
12. Outer cup
13. Shoe guide spring
14. Inner cup
15. Pin
16. Stub axle

**REPLACING REAR BRAKE SHOES****Disassembly**

Jack up the car at rear and remove the wheels.

Plug the outlet ports in the brake fluid reservoir to prevent fluid escaping during the following operations.

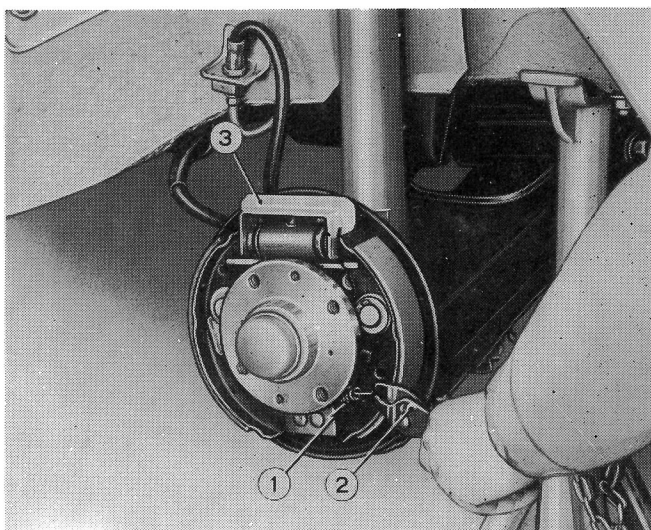
Remove both drum attaching screws (2-3) and remove the brake drum.



1. Brake drum
3. Brake drum attaching screw
3. Drum attaching screw and wheel location pin

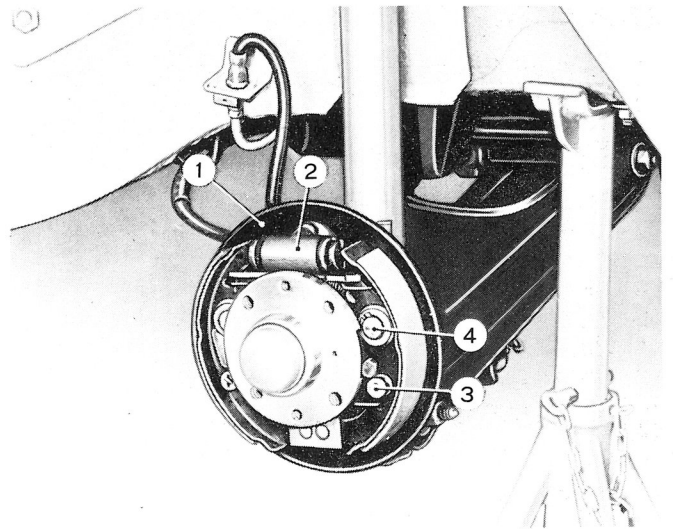
Affix tool A. 72257 (3) and using pliers unhook both upper and lower shoe return springs.

1. Lower shoe return spring
2. Pliers, curved nose
3. Tool A. 72257



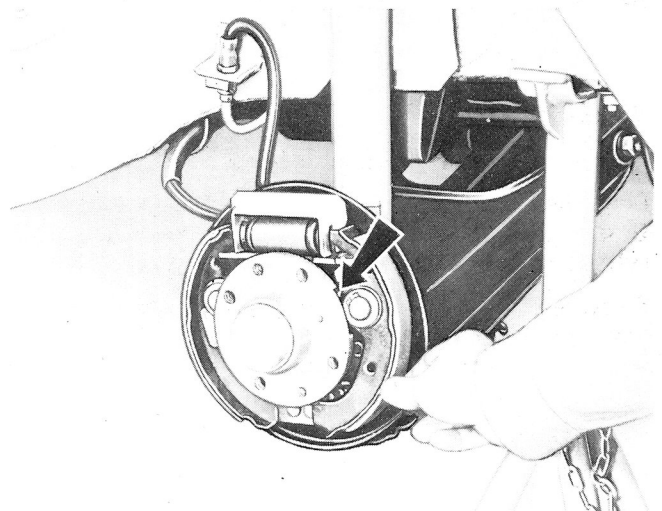
Tilt shoe guide pins and lift them out along with cups and springs. Then withdraw the shoe assemblies.

1. Brake backing plate
2. Wheel cylinder
3. Shoe guides
4. Shoe self-adjusting device



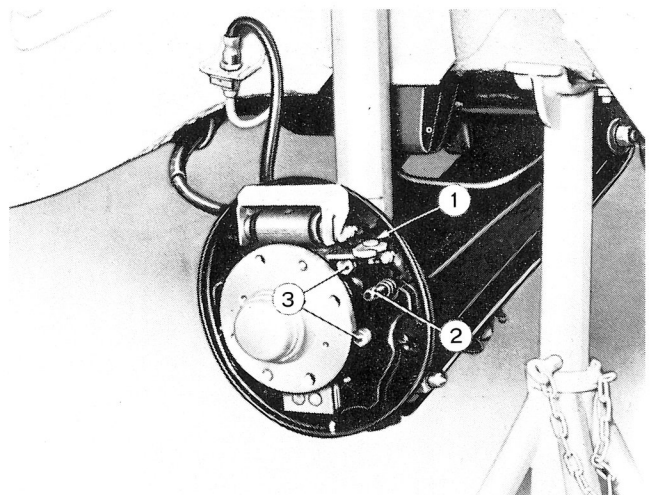
Disconnect the brake fluid hose from wheel cylinder.

NOTE: The groove cut on wheel hub, as shown by the arrow, should face toward the self-adjusting device to enable the removal of shoe.



Remove both screws and washers attaching the wheel cylinder to the brake backing plate and remove the wheel cylinder.

1. Hand brake shoe actuating lever
2. Self-adjusting device stud
3. Screws, brake backing plate to steering knuckle



INSPECTION

LINES AND CONNECTORS

The importance of a careful inspection of all brake lines cannot be overstressed, as this is instrumental in avoiding failure of the hydraulic system.

Whenever the brake system is serviced the following checks should be performed:

- 1) Inspect the metal tubing for kinks or cracks and make sure it is not chafing against sharp corners, to avoid possible damage.
- 2) Inspect rubber and fabric hoses for contamination from mineral oil or grease. Apply the brake pedal and make sure the hoses do not swell, which would be an indication of fluid leakage from the inner tube.
- 3) Make sure that all tubing anchor brackets are securely fastened. Loose anchor brackets will cause vibration of the tubing and danger of breakage.
- 4) Inspect all connectors for leakage. If necessary, tighten securely, using care to avoid twisting the tubes.

In all the above cases be safe and discard the parts affected, whenever there is any doubt about their serviceability.

WHEEL CYLINDERS

For an accurate inspection of wheel cylinder components, work on a bench and disassemble the wheel cylinders as follows:

Remove dust boots (1) then slide off both pistons (2), seal rings (4) backing washers (6) and reaction spring; then take out the bleeder screw (3).

Thoroughly check the cylinder bore and piston faces for a mirror-like appearance and absence of rough or grainy spots or excessive play.

Should any abnormal condition be detected in the cylinder bore correct it to avoid any fluid leaks or excessive wear of pistons or seals. Be sure that the wheel cylinder bore size is not affected.

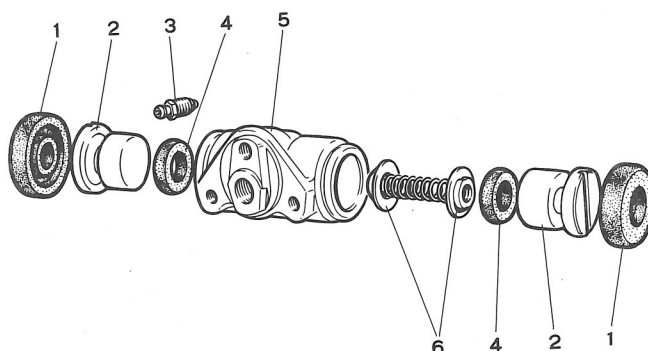
Check reaction spring for weakness and replace it, if necessary.

Check and preferably replace seal rings. Also inspect dust boots for damage and replace as required. Assemble the wheel cylinder. First liberally lubricate all components using only DOT 3 motor vehicle brake fluid to F.M.V.S.S. No. 116.

Slide parts into the cylinder body without forcing or damaging the working surfaces.

Install both dust boots.

Move pistons with both hands and make sure that the complete stroke is made without sticking.



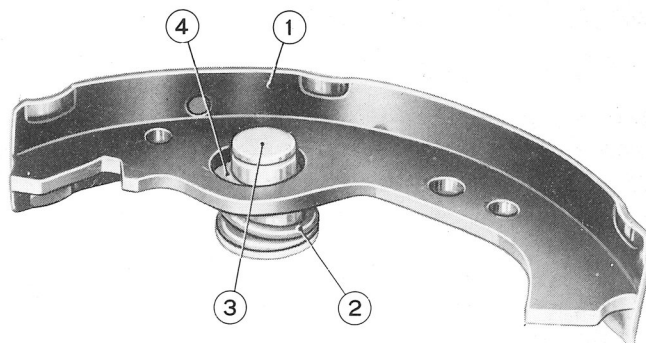
1. Dust boot
2. Pistons
3. Bleeder screw
4. Seal rings
5. Cylinder body
6. Backing washers and piston reaction spring

BRAKE SHOES

Thoroughly check brake shoes (1) to be sure that they are not cracked or distorted. Distorted shoes prevent uniform contact between lining and drum, impairing braking action. Replace parts as required.

Check that the guide pin can slide freely in its seating in the shoe and that the pin spring is not weakened.

Otherwise, replace the spring.



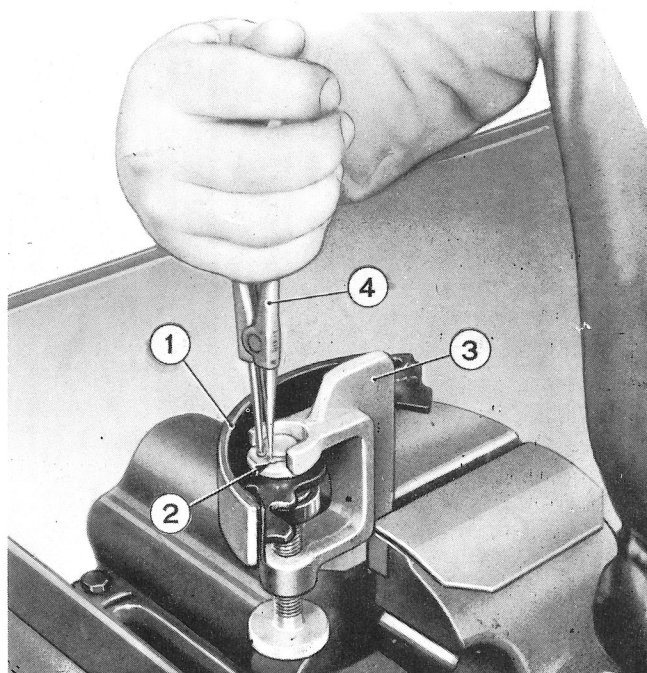
1. Brake shoe and lining
2. Spring
3. Casing
4. Friction washer

Check all components of the self-adjusting device for efficiency. Replace worn or damaged parts.

Before reassembling the self-adjuster, it will be necessary to make sure of spring efficiency. Use tester to check deflection rate by compressing springs to as low as 0.232 in. (15,9 mm). Corresponding load shown by tester indicator should be 101.4 lbs. (451 N) \pm 9.26 lbs. (41,2 N).

To assemble the self-adjuster, proceed as follows:

Place the items shown into the opening on shoe using tool A. 72246, install snap ring (2).



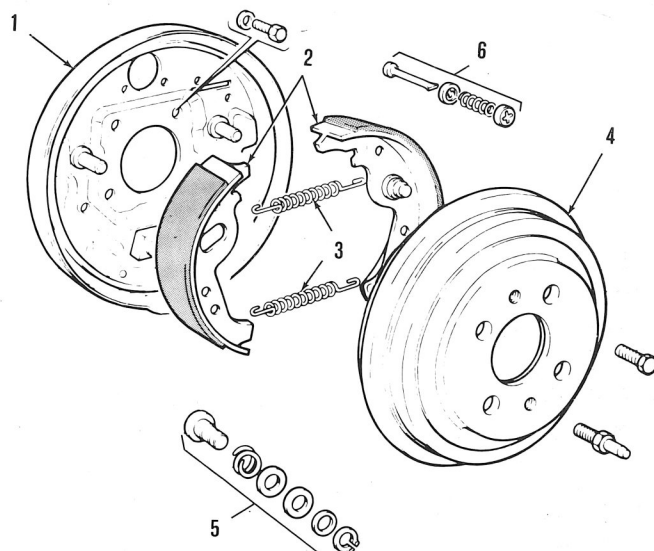
1. Brake shoe
2. Snap ring
3. Tool A. 72246
4. Pliers

Check shoe return springs, upper and lower, for weakness and replace them, if required.

Install both brake shoes and hook up the return springs. Push the shoes outward on the self-adjusters. Check to see that they stay in position.

Should the shoes be moved back by the return springs, recheck the shoe return springs and self-adjuster springs. The self-adjusting device should never be affected by return springs.

1. Brake backing plate
2. Brake shoes
3. Brake shoe return springs
4. Brake drum
5. Self-adjusting mechanism
6. Brake shoe retainer assembly



BRAKE DRUMS

Examine brake drums: if they are scored or excessively out-of-round, reface them and then lap to remove rough spots left by tool during turning on lathe.

1. Wheel cylinder
2. Brake backing plate
- 3-5. Shoe return springs
4. Shoe guides

Install the wheel cylinder on brake backing plate. Tighten both attaching bolts with washers, to a torque of 7.42 ft. lbs. (10 Nm).

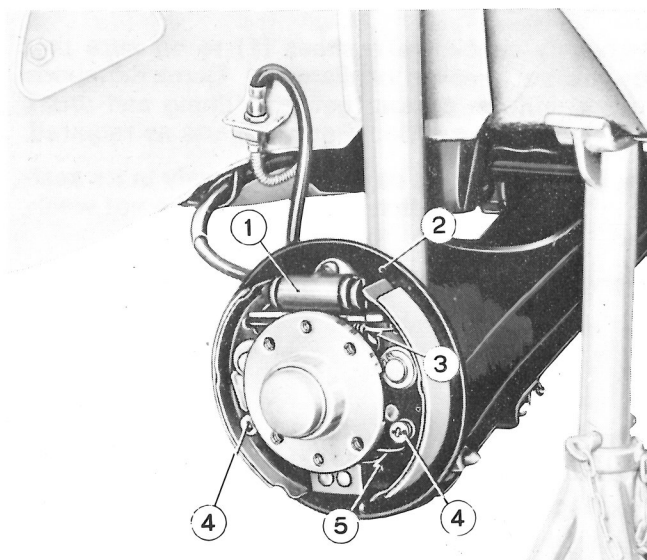
Connect the brake fluid hose, tightening the hose union.

Fit brake shoes, using care that shoe ends are correctly positioned in their seats on wheel cylinder and backing plate.

Slide guide pin on shoes, after spring and inner and outer cups have been placed.

Hook up lower and upper return springs.

Install the brake drum and tighten the two attaching screws (one screw serves also as a locating dowel for wheel installation).



BLEEDING

When the front or rear hydraulic system is opened for any reason, it must be bled to remove all trapped air. The front and rear systems are independent and need not be bled together. After all repairs are made, proceed as follows.

NOTE: Should the brake system have been completely drained, it is advisable to carry out the following operation before bleeding: Loosen all wheel bleed screws and pump brake pedal; as fluid begins to escape tighten bleed screws.

Fill brake fluid reservoir with DOT 3 brake fluid.

Clean all dirt and foreign material from bleed screws and remove protective caps.

Attach the bleed hose over bleed fitting in brake caliper or wheel cylinder. Submerge the other end of bleed hose into a clean jar half filled with brake fluid.

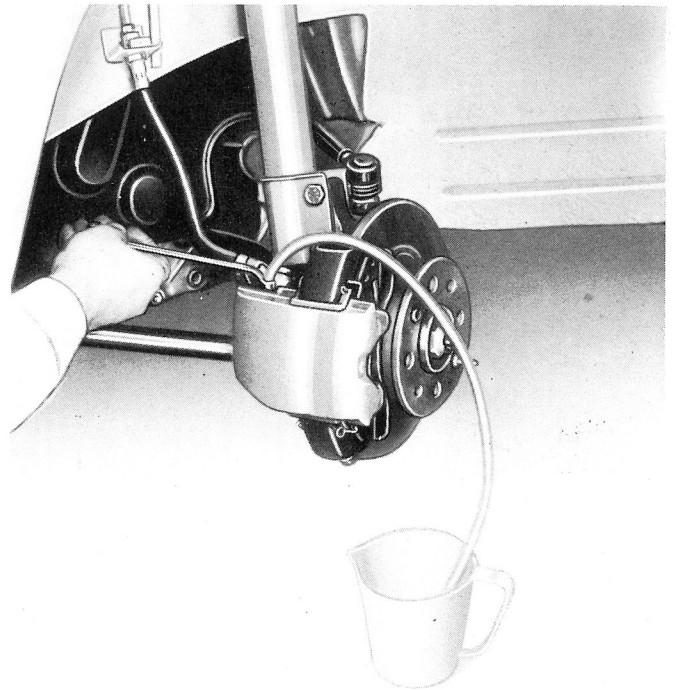
Loosen bleed screw one or two turns and press brake pedal down, allowing it to return slowly; do this several times until no more air bubbles escape from rubber hose.

Keeping brake pedal depressed, remove bleed hose and tighten bleed screw. Refit protection cap.

Repeat above on other wheels, making certain that fluid level in reservoir is maintained.

After bleeding, top up reservoir to prescribed maximum level.

Bleeding the front circuit



Bleeding the rear circuit



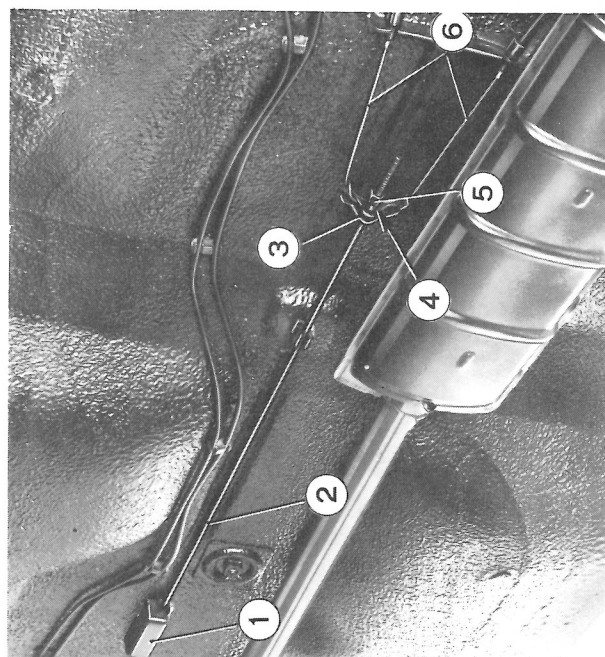
HAND BRAKE

The mechanical parking brake is operated through a ratchet lever acting on rear brake shoes.

When making an overhaul, check the condition of the cable and change it if there are any broken strands.

Make sure that the brake lever ratchet teeth are in perfect condition. If there is any wear, replace parts as required.

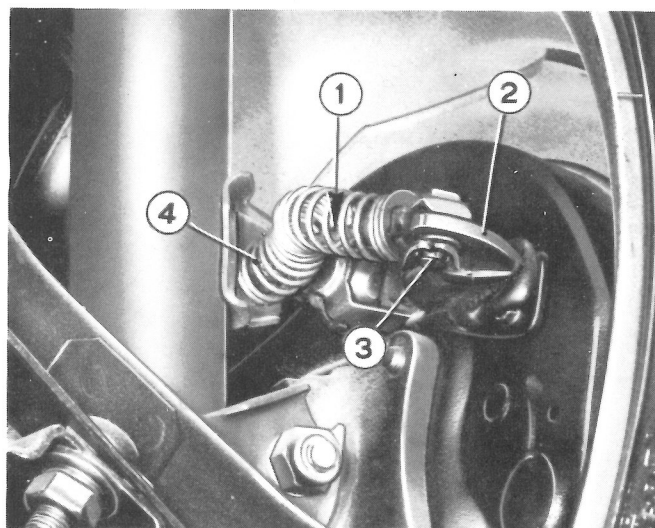
1. Gasket
2. Rod
3. Cable anchor
4. Adjusting nut
5. Lock nut
6. Cable with covering.



Inspect the actuating lever springs at the backing plate to be sure that they are not weak or broken, as this will result in the levers failing to return correctly.

Also check the reaction spring and housing for efficiency.

1. Cable
2. Lever
3. Anchor pin
4. Return spring



INSPECTION AND ADJUSTMENT

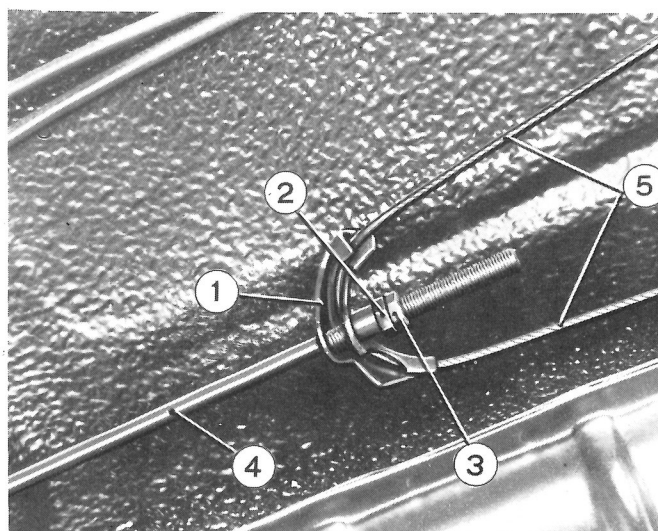
Adjust the travel of the lever as follows.

Fully depress the brake pedal a few times to have brake pistons assume their correct working position.

Starting from the released position, pull up the ratchet lever three or four clicks.

Loosen lock nut (3) then turn adjuster until wheels are locked securely (try to turn wheels manually). Tighten nut (2) and lock nut (3).

1. Anchor
2. Adjusting nut
3. Lock nut
4. Rod
5. Cable



BRAKE BOOSTER

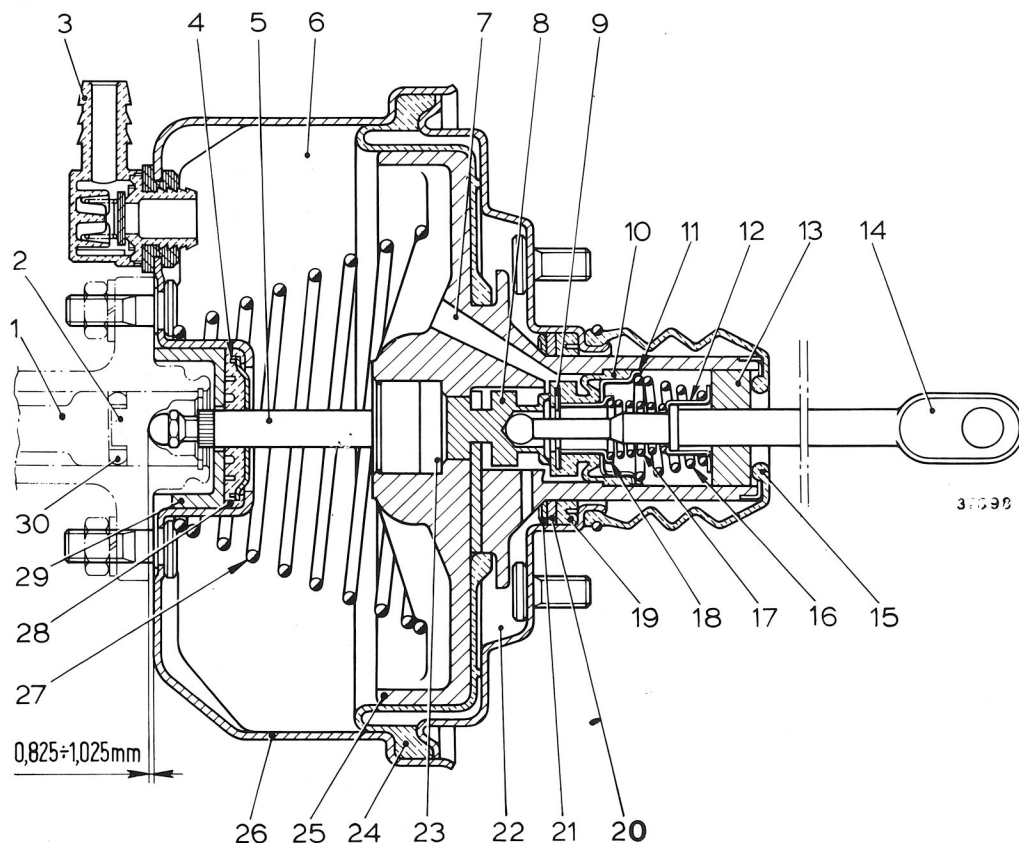
The booster is a vacuum operated pedal assist providing more uniform and efficient braking. The braking force is doubled as compared to vehicles without this unit.

Should the servo brake fail to function, its design enables the braking system of the vehicle to operate in a conventional way. In such a case fluid pressure is obtained from the master cylinder.

Adjustment

The booster adjustment is performed on control rod (5) carrying the adjustment screw end. In the rest position the screw end must project from the front booster surface by .032-.040 in. (0,825-1,025 mm).

After adjustment apply some adhesive to the screw threads.



Longitudinal section of the booster unit

- | | | |
|---------------------------------|---------------------------------|-------------------|
| 1. Master cylinder body | 11. Valve seat | 21. Seat |
| 2. Piston | 12. Spring seat | 22. End chamber |
| 3. Check valve | 13. Filter cartridge | 23. Disc |
| 4. Front seal ring | 14. Pushrod | 24. Diaphragm |
| 5. Hydraulic piston control rod | 15. Guard | 25. Piston |
| 6. Front chamber | 16. Piston - valve spring | 26. Front cover |
| 7. Depression groove | 17. Sealing valve return spring | 27. Return spring |
| 8. Valve piston | 18. Valve seat | 28. Seat |
| 9. Gasket centering ring | 19. End gasket | 29. Pilot bushing |
| 10. Valve | 20. Gasket | 30. Sealing ring |

REAR BRAKE PRESSURE COMPENSATOR

INSTALLATION

Secure the compensator with bar and boot, to its bracket by means of two bolts (7). Do not tighten them up, so that the adjustment described below can be made. Attach bar (3) to the body with bracket.

INSPECTION AND ADJUSTMENT

Bring end (3b) of bar to $2.362 \pm .197$ in (60 ± 5 mm) from the center of buffer mounting hole (2).

- Raise dust boot (9) to check contact between regulator and bar.
- Rotate regulator body on either bolt (7) until the end of piston (8) is in contact with bar end (3a).
- Tighten bolts (7) to 18,5 Ft. lb (25 Nm) of torque, starting from the lower one.
- Attach link (4) to the bracket (6) pin at control arm (11).
- Install spring fastener on link pin (5).

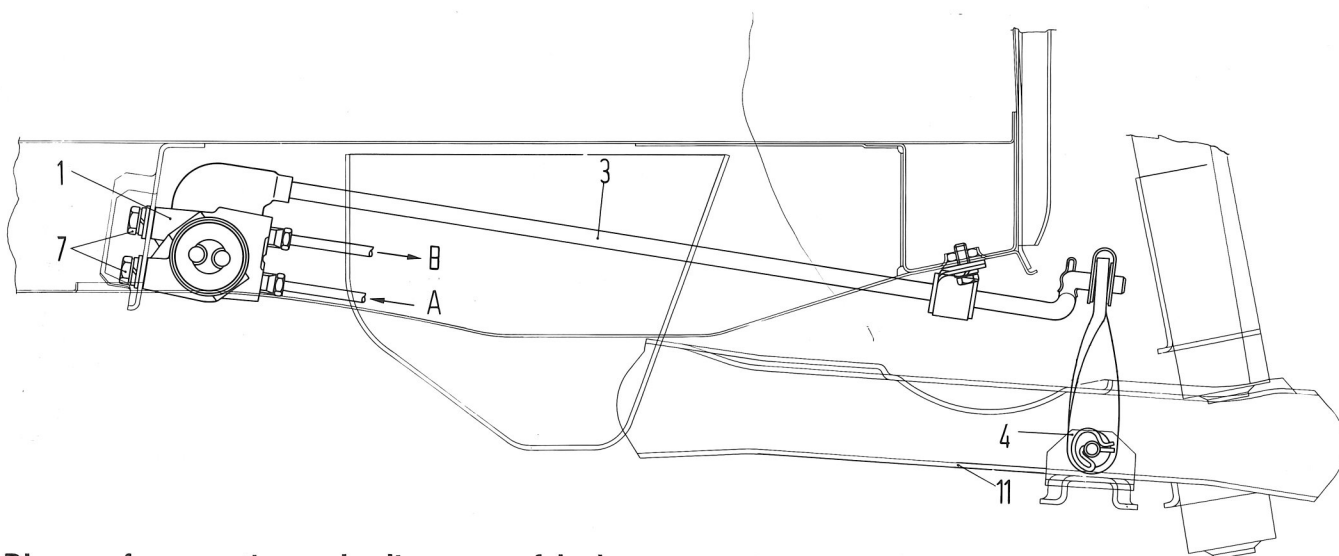
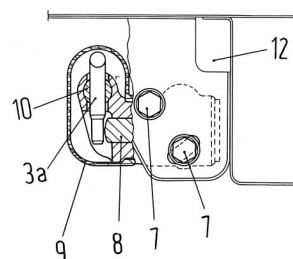
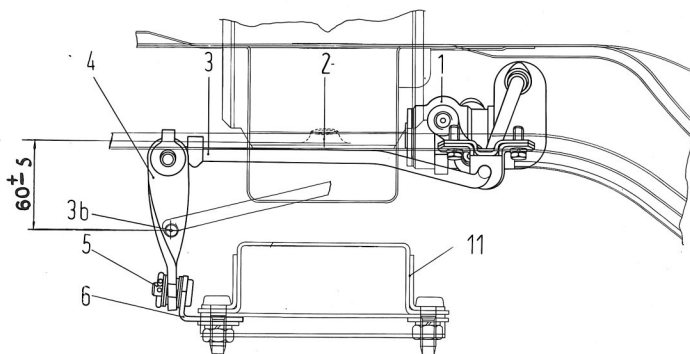
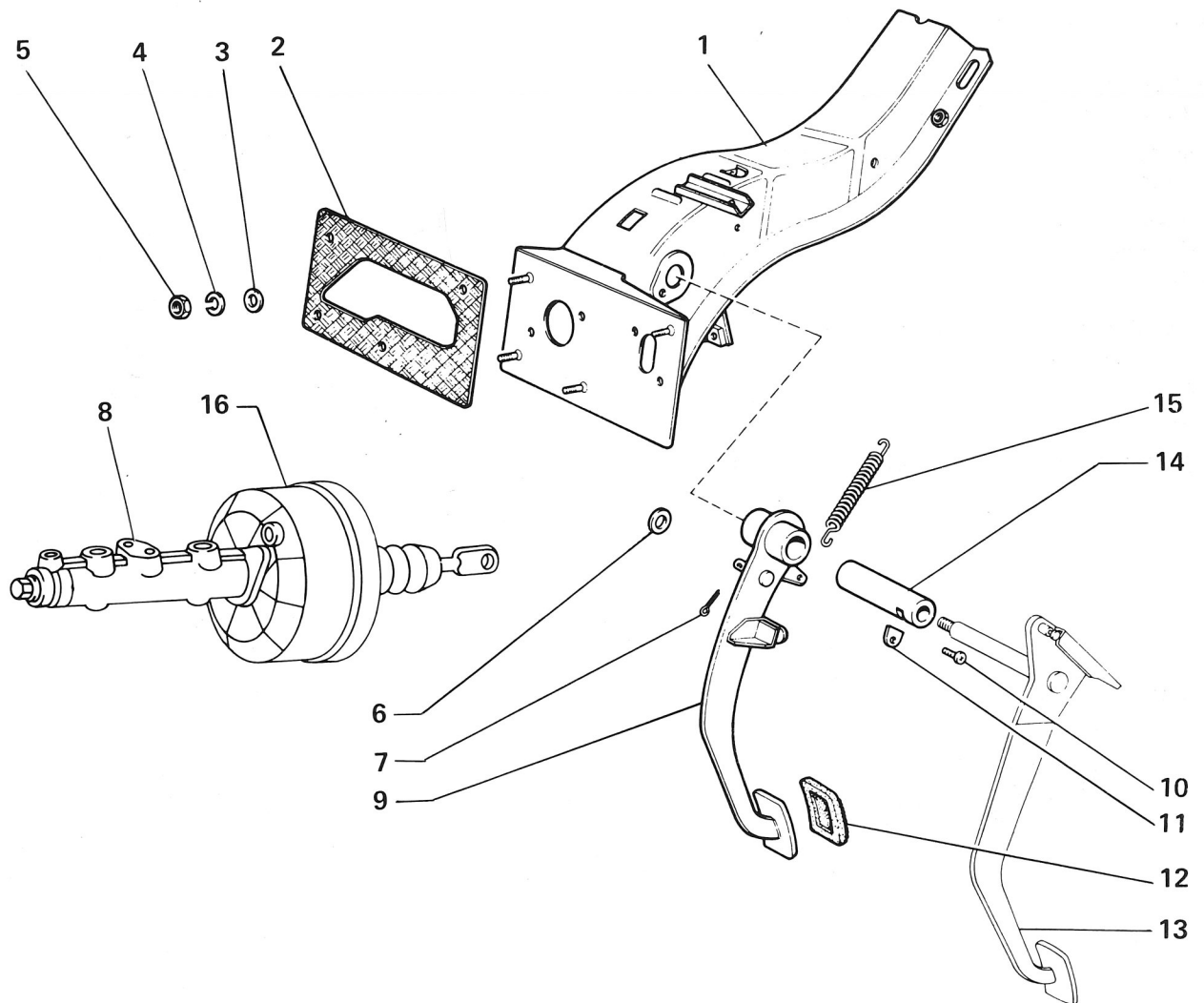


Diagram for mounting and adjustment of brake pressure regulator

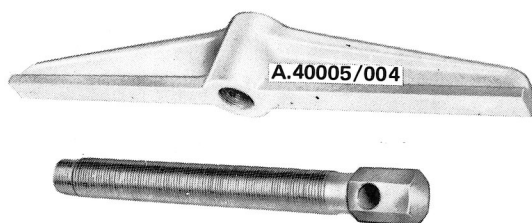
- | | |
|------------------------------------|--|
| 1. Brake compensator | 7. Brake compensator attaching and adjusting bolts |
| 2. Buffer housing | 8. Compensator piston |
| 3. Bar | 9. Dust boot |
| 3a. Compensator end of torsion bar | 10. Regulator pin |
| 3b. Anchor link of torsion bar | 11. Control arm |
| 4. Torsion bar link to control arm | 12. Compensator mounting bracket |
| 5. Link anchor pin to control arm | |
| 6. Link anchor pin bracket | |
- $2.362 \pm .197$ in (60 ± 5 mm) = Bar position for setting compensator
- A. Fluid inlet line from master cylinder B. Fluid outlet line to rear wheel cylinders



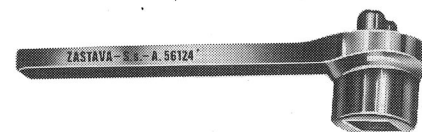
Detail of brake and clutch pedals, support and master cylinder

- | | | |
|------------------|--------------------------|-------------------------------|
| 1. Support | 7. Cotter pin | 13. Clutch pedal |
| 2. Gasket | 8. Brake master cylinder | 14. Spacer |
| 3. Plain washer | 9. Brake pedal | 15. Brace pedal return spring |
| 4. Spring washer | 10. Screw | 16. Booster |
| 5. Nut | 11. Tab washer | |
| 6. Plain washer | 12. Pad-pedal | |

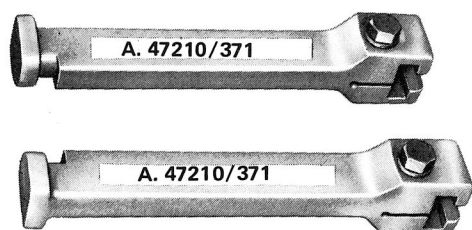
SERVICE TOOLS



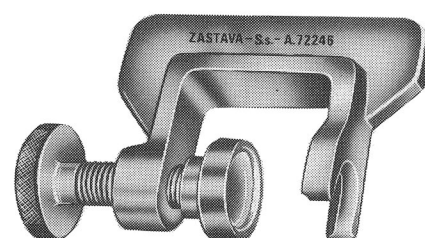
A. 40005/004 Puller (300 mm) with bolt (22 x 2 mm) for removal of front brake discs (use with A. 47211/755 and A. 47210/371).



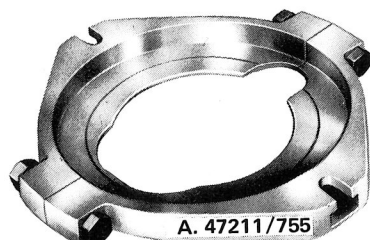
A. 56124 Wrench, brake action compensator disassembly.



A. 47210/371 Pair of pullers (180 mm long) for use with A. 47211/755 and A. 40005/004 in removal of front brake discs.



A. 72246 Tool, disassembly and reassembly of wheel brake shoe self-adjusting device.



A. 47211/755 Pair of ring grips, for front wheel brake disc removal (to be used with A. 40005/004 and A. 47210/371).



A. 72257 Set of tools, wheel cylinder piston retainment during assembly.

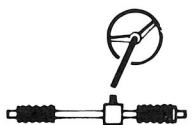

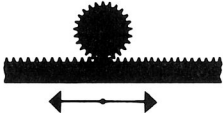
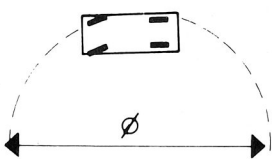
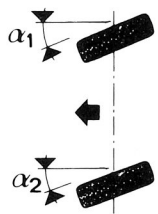
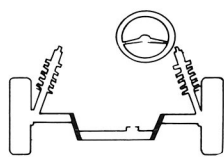

STEERING

STEERING

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RACK	5-6
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SPECIFICATIONS

STEERING MECHANISM

TYPE	 RACK AND PINION		
STEERING WHEEL TURNS LOCK TO LOCK		3,4	
RACK TRAVEL		5.118 ± .0039 in	130 ± 1 mm
 MINIMUM TURNING CIRCLE		31 Ft 2 in	9,5 m
 TURNING ANGLE	OUTER WHEEL	32°	
	INNER WHEEL	34° 15'	
 STEERING COLUMN	with 2 universal joints 		

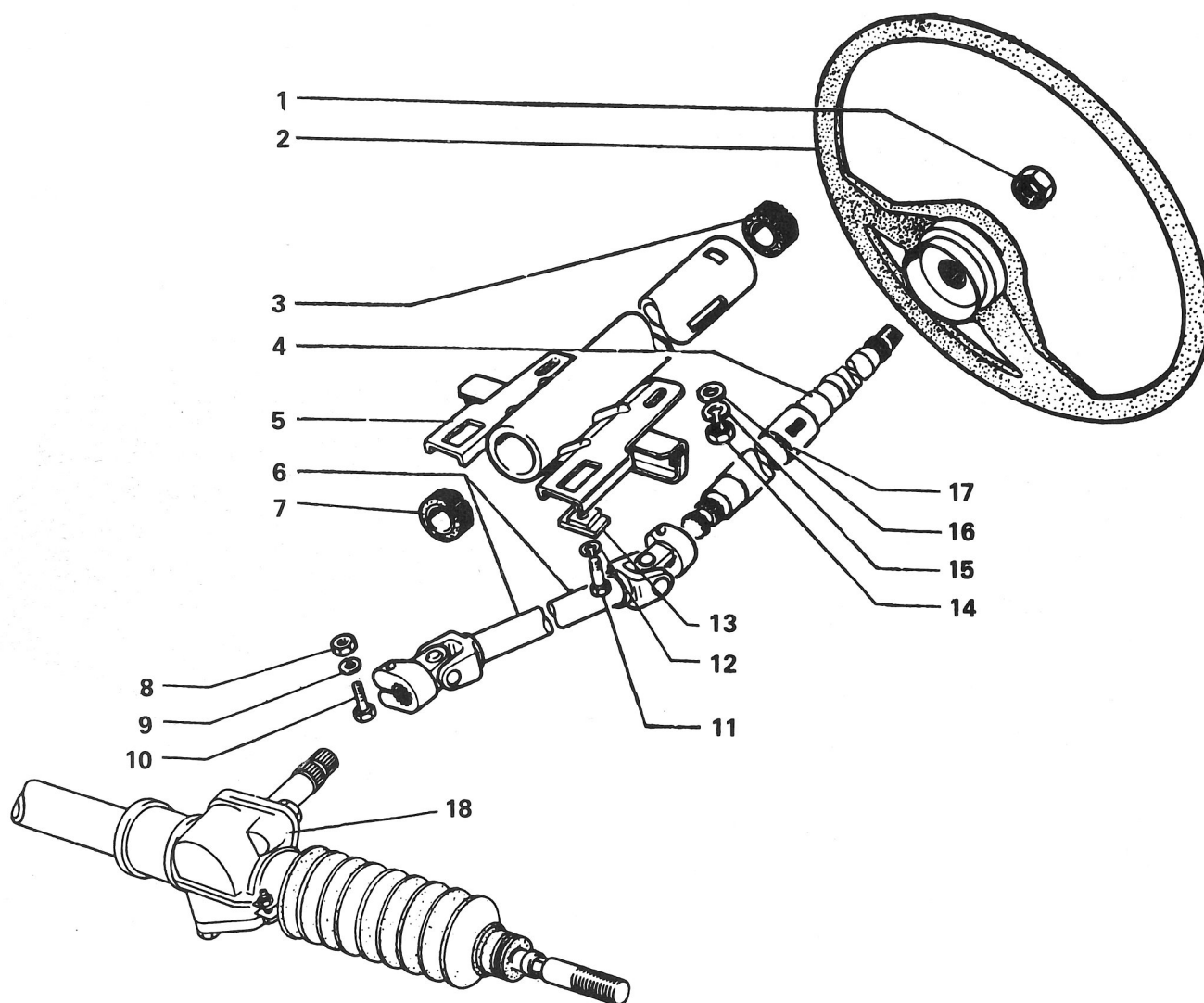
TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Torque		
		Ft. Lb.	Kgm	Nm
Steering wheel nut	M 16 x 1,5	36	5	49
Universal joint fork nut	M 8	19	2,6	26
Rack mounting bolt	M 8	19	2,6	26
Rack ball joint lock nut	M 14 x 1	36	5	49
Tie rod end nut	M 10 x 1,25	25	3,5	34

STEERING WHEEL

REMOVAL AND INSTALLATION

Center the steering wheel and the front wheels. Disconnect the battery ground cable. Pry the horn button off steering wheel. Remove the horn button spring. Remove nut (1) holding wheel (2) to shaft (4). Mark steering wheel and steering shaft for installation reference. Pull the wheel off the shaft. Install the steering wheel in reverse order. Torque nut (1) to 36 ft. lbs (5 kgm).



1. Nut
2. Steering wheel
3. Bushing
4. Upper shaft
5. Support
6. Lower shaft
7. Bushing

8. Nut
9. Lockwasher
10. Bolt
11. Bushing
12. Retainer
13. Bolt
14. Housing

15. Bolt
16. Lockwasher
17. Nut plate
18. Nut
19. Lockwasher
20. Washer

STEERING BOX**REMOVAL AND INSTALLATION**

Center the steering wheel and front wheels. Mark the universal joint and the steering box shaft for installation reference.

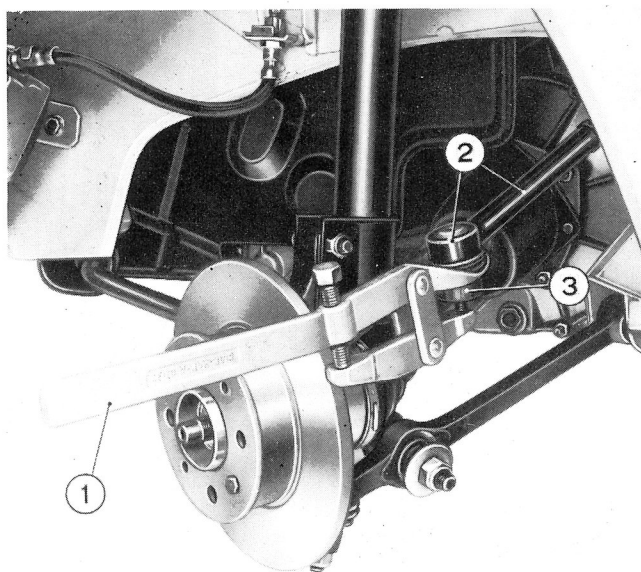
Remove the bolt and nut holding the universal joint to the steering box shaft.

Raise front of car

Remove the nut holding the ball joint on the tie rod (2) to the steering knuckle (3).

Install puller A. 47035 (1) on the ball joint. Tighten the bolt on the puller to separate the ball joint from the steering knuckle, repeat for other side.

1. Puller A. 47035 2. Tie rod 3. Steering knuckle

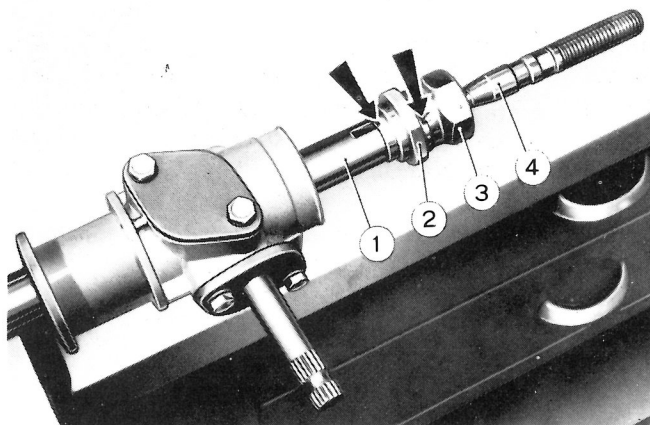


Remove the bolts holding the steering box to the body, remove the steering box from the car.

Install in reverse order. Torque bolts to specifications. Check front wheel toe.

DISASSEMBLY

Remove the four clamps. Remove the rubber boots. Mount the steering box in a vise and straighten the stakes on the lock nuts (2) for the ball joint sockets (3). Unscrew the ring nuts and slide the ball joints off with their sockets and springs.



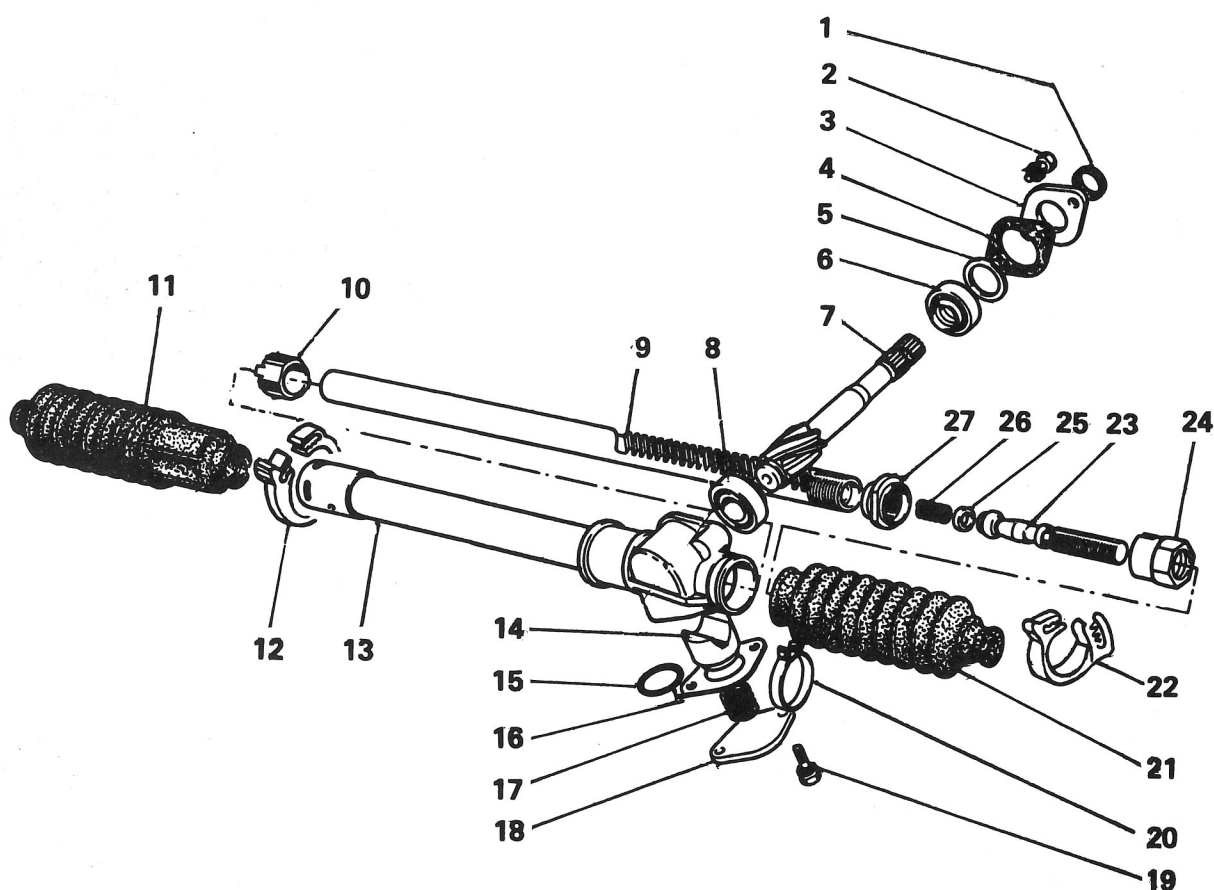
1. Rack 2. Lock nut 3. Ball joint socket 4. Ball joint stud

Remove two bolts (19), cover (18), shim (16), Spring (17), seal (15), and thrust block (14).

Remove two bolts (2), seal (1), cover (3), plate (4), shim (5), bearing (6) and pinion (7) from housing.

Slide rack (9) from housing (13). Remove bushing (10) from rack.

Remove bearing (8) from housing.



- | | | | |
|------------|------------------|-----------------|-------------------------|
| 1. Seal | 8. Bearing | 15. Seal | 22. Clamp |
| 2. Bolt | 9. Rack | 16. Shim | 23. Ball joint stud |
| 3. Cover | 10. Bushing | 17. Spring | 24. Ball joint socket |
| 4. Gasket | 11. Rubber boot | 18. Cover | 25. Seat |
| 5. Shim | 12. Clamp | 19. Bolt | 26. Spring |
| 6. Bearing | 13. Housing | 20. Clamp | 27. Ball joint lock nut |
| 7. Pinion | 14. Thrust block | 21. Rubber boot | |

INSPECTION (REFER TO FIGURE ON PREVIOUS PAGE)

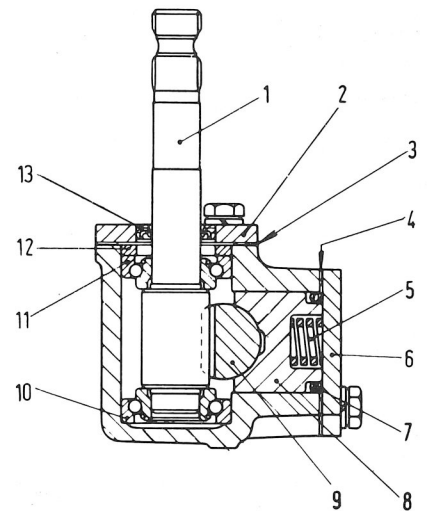
Before inspection, clean all metallic parts in a suitable degreaser. Blow the parts dry. Inspect rack (9) pinion (7), bearing (8), and housing (13) for wear, scratches, broken teeth or other damage. Replace entire steering box if damaged.

Inspect rubber boots (11 & 21) for tears or breaks that would permit moisture entry. Replace if damaged.

Before reassembly, coat all bearing and gear surfaces with 90 W oil or pack rack and pinion housing and boots with a total of 5.3 oz. (.127 kg) of lithium-base grease containing molybdenum disulphide.

Section through steering box and drive pinion

- | | |
|-----------------------|-------------------|
| 1. Pinion | 7. Seal |
| 2. Cover | 8. Thrust block |
| 3. Gasket | 9. Rack |
| 4. Rack thrust block | 10. Lower bearing |
| 5. Spring | 11. Top bearing |
| 6. Thrust block cover | 12. Pinion shim |
| | 13. Pinion seal |



PINION ADJUSTMENT

Remove the two bolts, cover with seal, plate, and shim to gain access to the pinion bearing.

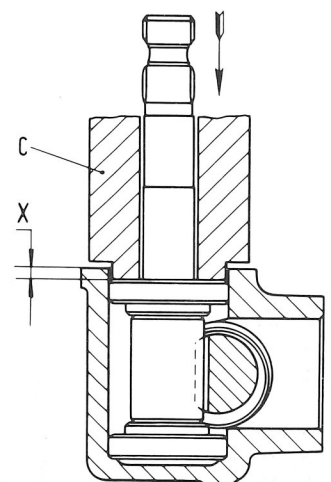
Using a suitable driver, make sure the bearing is firmly seated.

Measure distance from top of bearing to pinion cover facing (dimension X).

To dimension X, add $.003 \pm .002$ in. (0.078 ± 0.053 mm). Combine shims to make up new dimension. Shims available are .0047, .008, .010, and .018 in. (0.12, 0.20, 0.25, and 0.50 mm).

Carefully install shims so they are centered on the pinion.

Install plate, cover with seal and two bolts.



RACK ADJUSTMENT

Center the rack in its travel.

Remove the two bolts, cover, shims and spring to gain access to the rack thrust block.

While holding the rack thrust block against the rack, turn pinion through 180° to seat the rack with the pinion.

Measure distance from top of rack thrust block to cover facing (dimension Y).

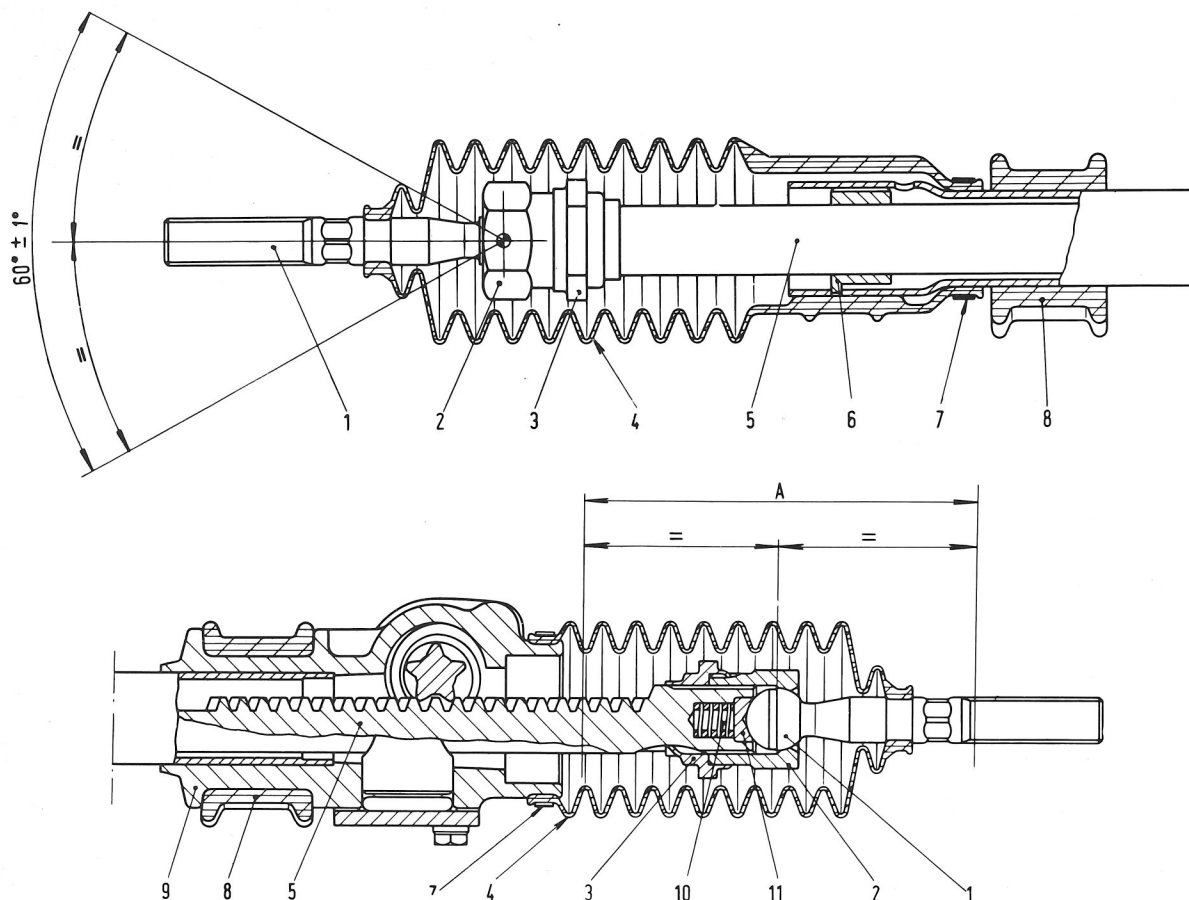
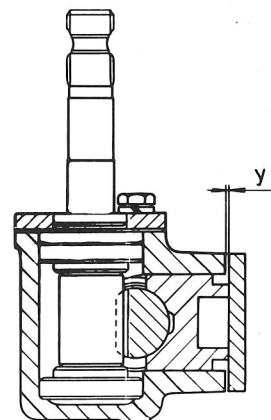
To dimension Y, add $.0035 \pm .0015$ in. (0.09 ± 0.04 mm). Combine shims to make up new dimension. Shims available are .0039 and .0059 in. (0.10 and 0.15 mm).

Install shims, cover, and two bolts.

Reassemble in reverse order. Use tool A. 74247 to install bushing (10).

Hand tighten the ball joint sockets until they are snug. Check that the ball joint studs move smoothly in all directions, but are not loose enough to swing down under their own weight.

Then tighten the locknuts to the specified torque. Stake the ball joint socket and the locknut with a punch.



Cross section of steering box

1. Ball joint studs
2. Ball joint socket
3. Ball joint lock nuts
4. Rubber boots

5. Rack
6. Bushing
7. Clamps
8. Rubber bushing

9. Housing
10. Spring
11. Seat

Rack travel A = 5.118 in (130 mm) travel.

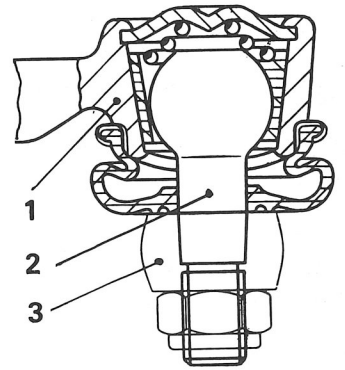
Angle of ball joint movement: $60^\circ \pm 1^\circ$

TIE RODS

Make sure that the tie rod ball is not loose in its socket.

If it shows signs of play, or the boot is damaged, replace the tie rod end.

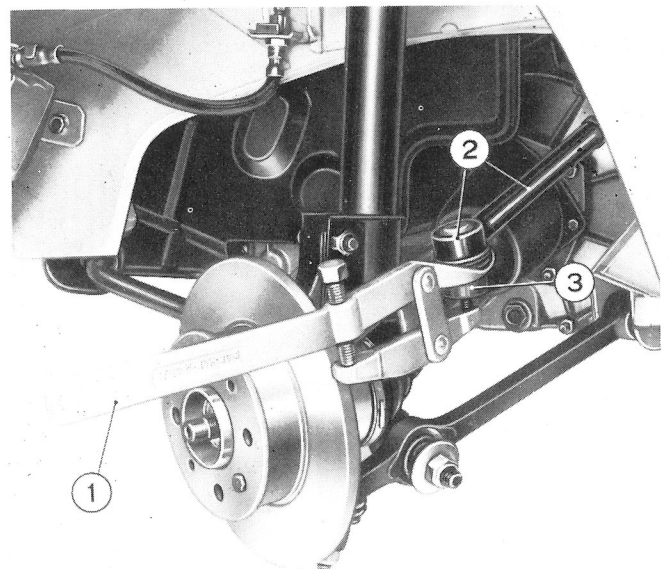
1. Tie rod end 2. Tie rod ball stud 3. Steering arm.

**Raise front of car**

Remove the nut holding the ball joint on the tie rod (2) to the steering knuckle (3).

Install puller A. 47035 (1) on the ball joint. Tighten the bolt on the puller to separate the ball joint from the steering knuckle, repeat for other side.

1. Puller A. 47035 2. Tie rod 3. Steering knuckle.

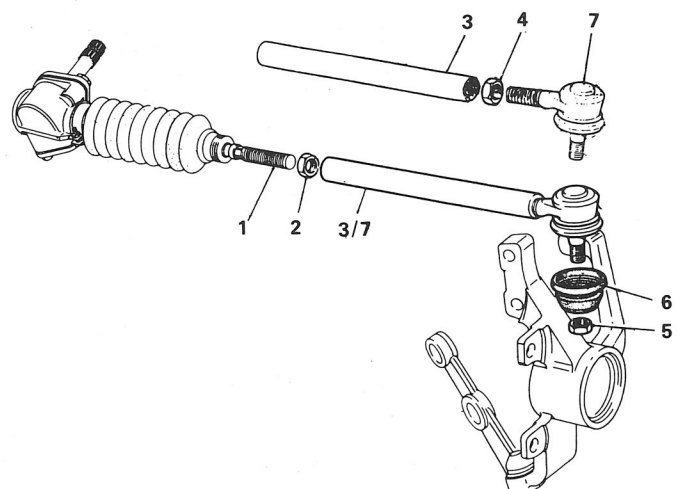


Tie rods may have either configuration shown here.

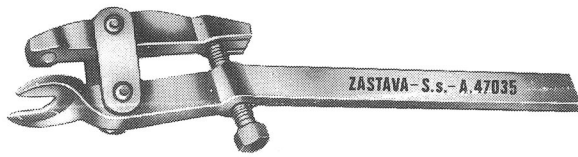
When the tie rod is supplied with a sleeve (3) separate from tie rod end (7), adjust toe by loosening locknuts (2) and (4), and turning sleeve (3).

When the rod is supplied with sleeve (3) and tie rod end (7) in one piece (3/7), adjust toe by loosening locknut (2) and turning the steering rack ball joint stud (1). Then retorque locknut.

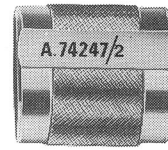
- 1. Ball joint stud
- 2. Locknut
- 3. Tie rod
- 4. Locknut
- 5. Nut
- 6. Boot
- 7. Tie rod end
- 3/7 Tie rod with end



SERVICE TOOLS



A. 47035 Puller, for steering ball joints.



A. 74247 Installer, rack guide bushing.

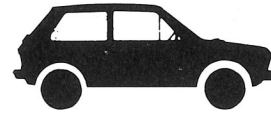
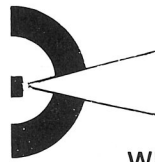
SUSPENSIONS

SUSPENSIONS

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REAR SUSPENSION	6-13
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SPECIFICATIONS

SUSPENSION



WHEEL ANGLES

		RANGE	MIN	PREF	MAX
FRONT SUSPENSION	 CAMBER	$1^{\circ}30' \pm 30'$	1°	$1\ 1/2^{\circ}$	2°
		$*\ 1^{\circ} \pm 30'$	$*\ 1/2^{\circ}$	$*\ 1^{\circ}$	$*\ 1\ 1/2^{\circ}$
	 CASTER	$2^{\circ}15' \pm 30'$ $*\ \text{Same}$	$1\ 3/4^{\circ}$	$2\ 1/4^{\circ}$	$2\ 3/4^{\circ}$
	 TOE - OUT	$0 \pm 1/32\ \text{in}$ $(0 \pm 1\ \text{mm})$	$1/32\ \text{in}$ $(1\ \text{mm})$ IN	0	$1/32\ \text{in}$ $(1\ \text{mm})$ OUT
REAR SUSPENSION	 CAMBER	$-30' \pm 30'$	0°	$-1/2^{\circ}$	-1°
		$*\ -3^{\circ} \pm 30'$	$-2\ 1/2^{\circ}$	-3°	$-3\ 1/2^{\circ}$
	 TOE - IN	$3/16 \pm 1/16\ \text{in}$ $(4 \pm 2\ \text{mm})$	$1/8\ \text{in}$ $(2\ \text{mm})$	$3/16\ \text{in}$ $(4\ \text{mm})$	$1/4\ \text{in}$ $(6\ \text{mm})$
		$*\ \text{Same}$			

Note: Specifications for empty vehicles are published for your convenience.

* FULL LOAD = 4 PEOPLE 684 Lb (310 kg) + CARGO 88 Lb (40 kg) = 772 Lb (350 kg)

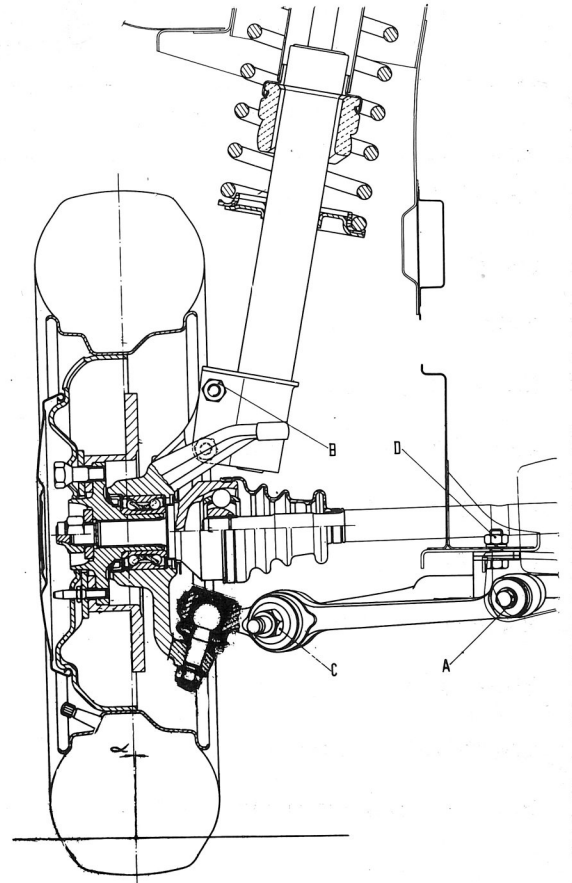
WHEELS

 TIRES	TYPE	145 SR x 13 in
	PRESSURE (COLD) } FRONT	24 p.s.i. (1,7 bar)
	} REAR	27 p.s.i. (1,9 bar)
RIM	TYPE	4 1/2 J x 13 in

TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Torque		
		Ft. Lb	Kgm	Nm
FRONT SUSPENSION				
Lug bolt	M 12 x 1,25	63	8,7	86
Hub (Spindle) nut	M 20 x 1,5	159	22	216
Brake caliper support bolt	M 10 x 1,25	35	4,8	47
Sway bar nut at control arm	M 14 x 1,5	43	6	59
Control arm bolt at body	M 10 x 1,25	29	4	39
Strut upper mount nut	M 6	9	1,2	12
Sway bar bracket bolt/nut	M 10 x 1,25	36	5	49
Strut lower mount bolt/nut	M 10 x 1,25	53	7,3	72
Lower ball joint nut	M 12 x 1,25	58	7,9	78
Shock absorber top stem nut	M 8	18	2,5	25
REAR SUSPENSION				
Lug bolt	M 12 x 1,25	63	8,7	86
Hub (Stub axle) nut	M 20 x 1,5	159	22	216
Shock absorber upper mount nut	M 10 x 1,25	18	2,5	25
Spring anchor nuts on control arm	M 10 x 1,25	22	3	29
Control arm mount nuts at body	M 10 x 1,25	36	5	49
Control arm/stub axle bolt/nut	M 12 x 1,25	58	7,9	78
Shock absorber/stub axle bolt/nut	M 10 x 1,25	43	5,9	59
Brake backing plate bolts	M 8	18	2,5	25
Control arm pivot pin nuts	M 10 x 1,25	36	5	49

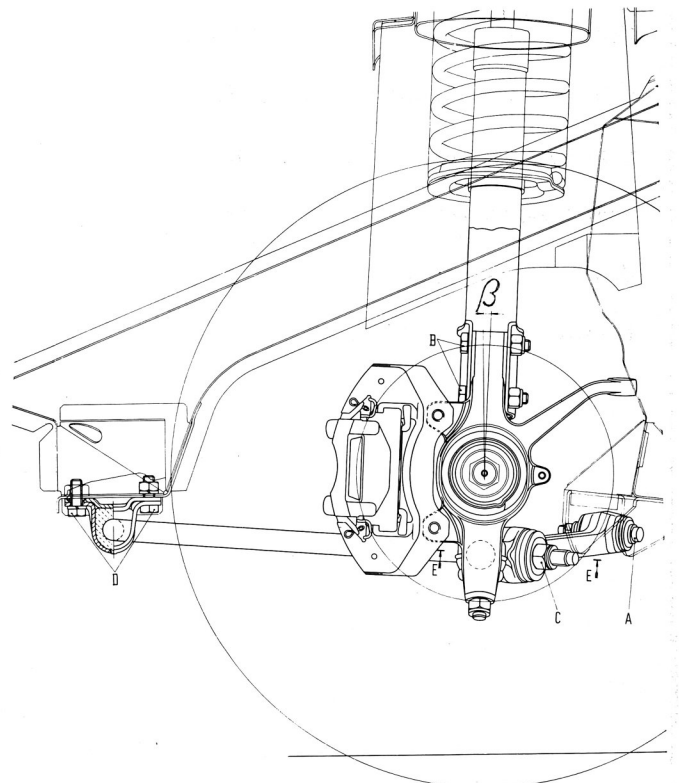
\angle = Camber angle



Cross section of wheel and front left suspension

- A. Control arm pivot bolt at body
- B. Strut lower mount bolt/nut
- C. Sway bar nut at control arm
- D. Sway bar bracket bolt/nut

β = Caster angle



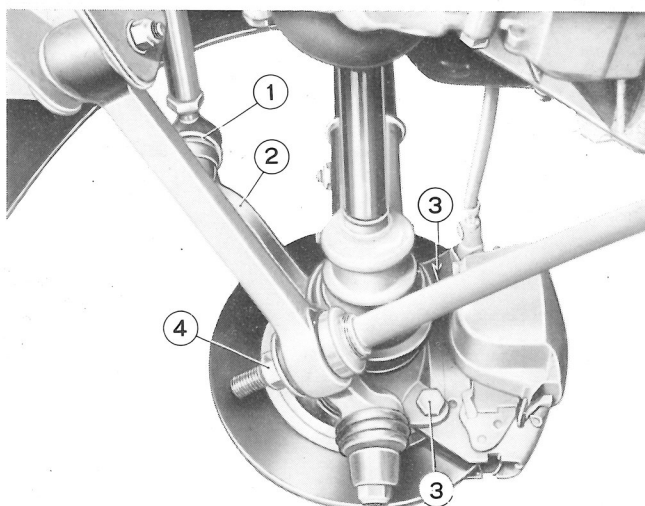
FRONT SUSPENSION

REMOVAL

Raise the car and remove the wheel. Remove bolts (3) holding the brake caliper to the knuckle. Remove the caliper and secure it out of the way.

Remove the nut holding the ball joint (1) for the tie rod to the steering knuckle. Using puller A.47035, remove the joint from the steering knuckle.

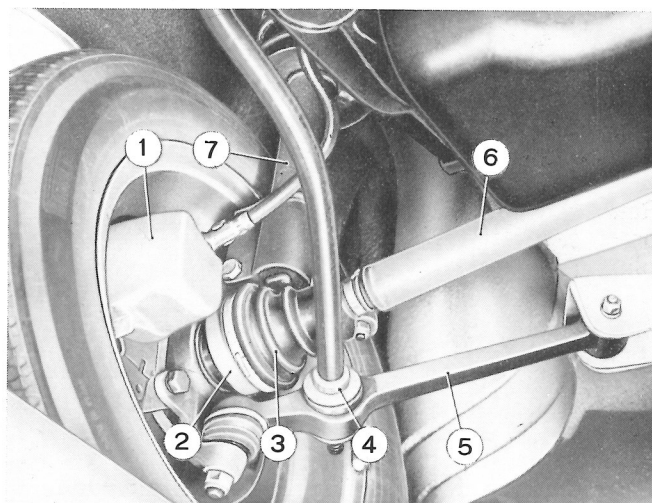
1. Tie rod ball joint
2. Steering knuckle
3. Caliper bolts
4. Sway bar nut



Remove the nut and adjustment shims (4) securing the sway bar to the control arm (5).

NOTE: When removing the sway bar from the control arm, note the number of adjustment shims between the end of the bar and the control arm bushing.

1. Brake caliper
2. CV joint
3. Boot
4. Adjustment shims
5. Control arm
6. Axle shaft
7. Shock absorber



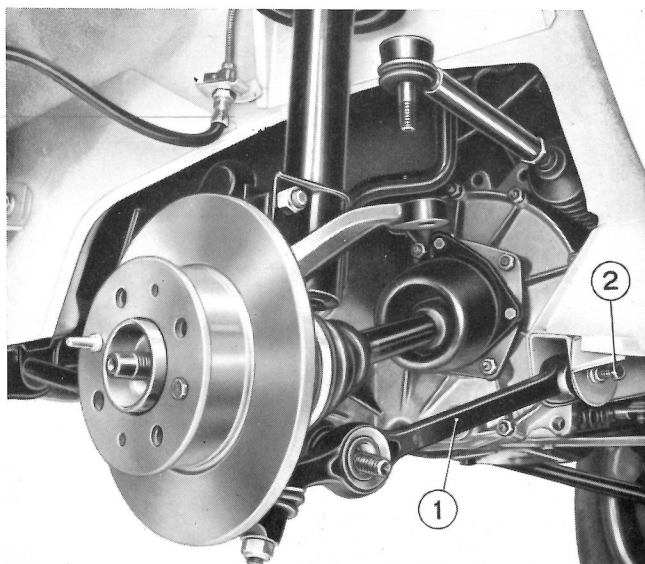
Remove the bolt and nut (2) holding the control arm (1) to the body bracket.

Remove the hub nut.

Support the front suspension and remove the three nuts attaching the strut to the body in the engine compartment.

Slide the suspension assembly off the CV joint shaft and remove it from the car. Secure the axle shaft to prevent it from slipping out of the differential.

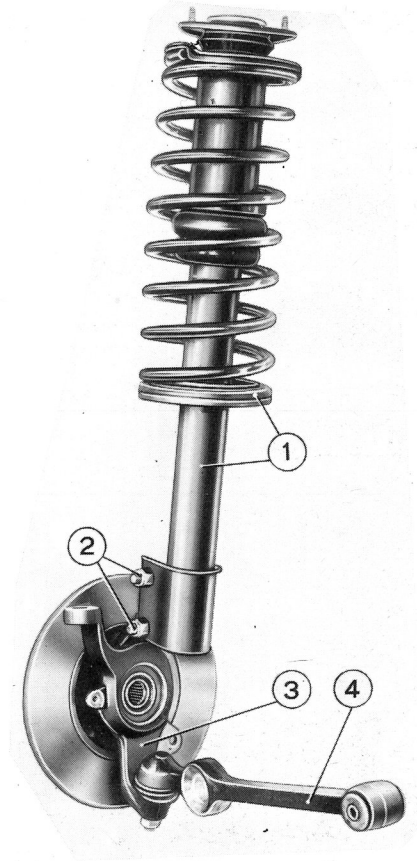
1. Control arm
2. Nut



DISASSEMBLY

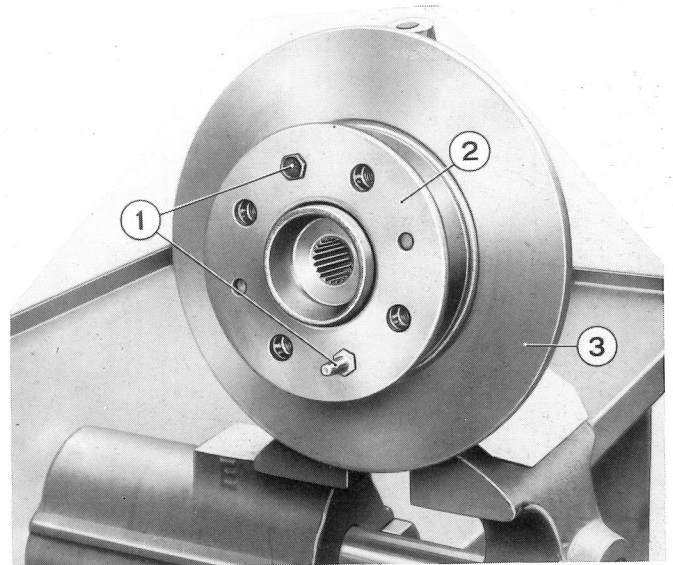
Remove the two bolts and nuts (2) holding the strut assembly to the knuckle. Remove the strut assembly.

1. Strut assembly
2. Bolt and nut
3. Knuckle
4. Control arm.

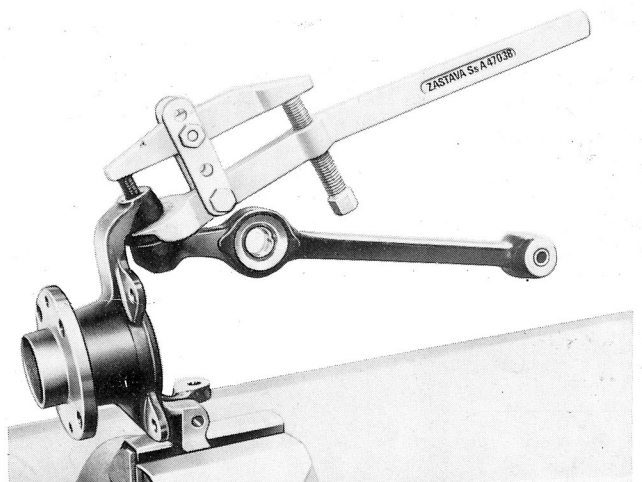


Remove the locating pin and bolt (1) holding the brake disc (3) to the hub. Remove the disc and plate (2).

1. Bolt and locating pin
2. Plate
3. Brake disc

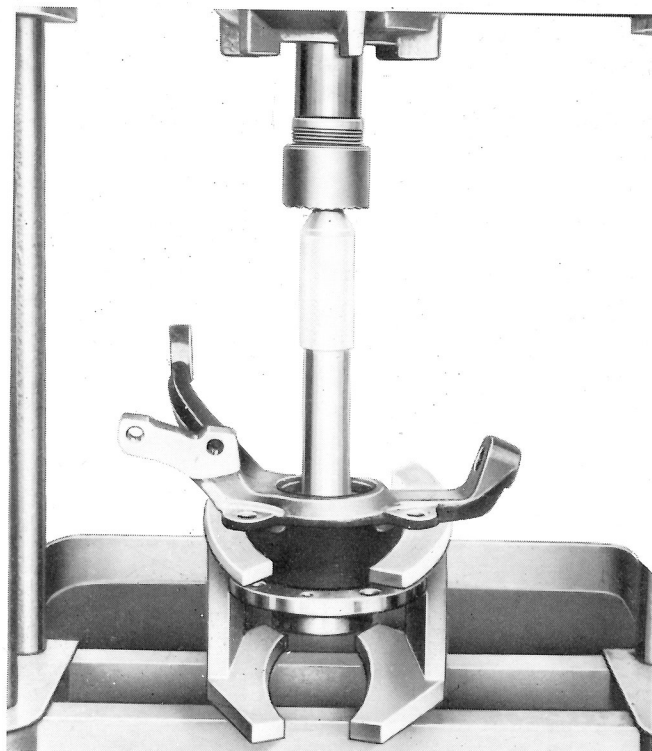


Remove the nut holding the ball joint for the control arm in the knuckle. Using puller A. 47036, remove the ball joint from the knuckle.

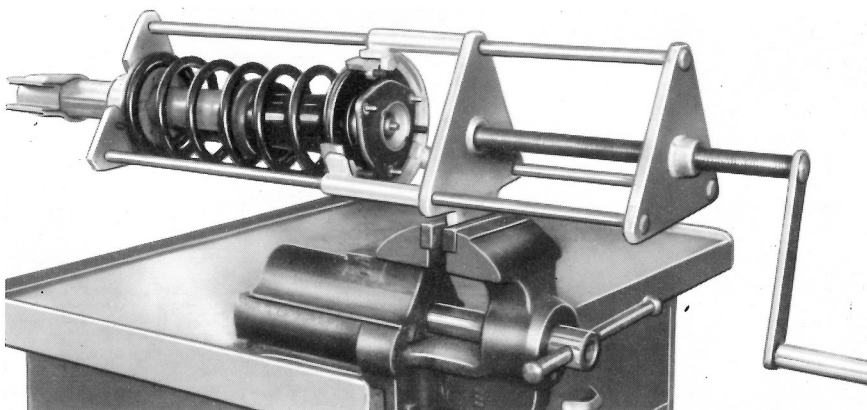


Place the knuckle in a press and remove the hub.

Remove the ring nut holding the bearing in the knuckle using tool A. 57123. Remove the bearing.



Place the strut assembly in fixture A. 74241.
Place the fixture in a vise.

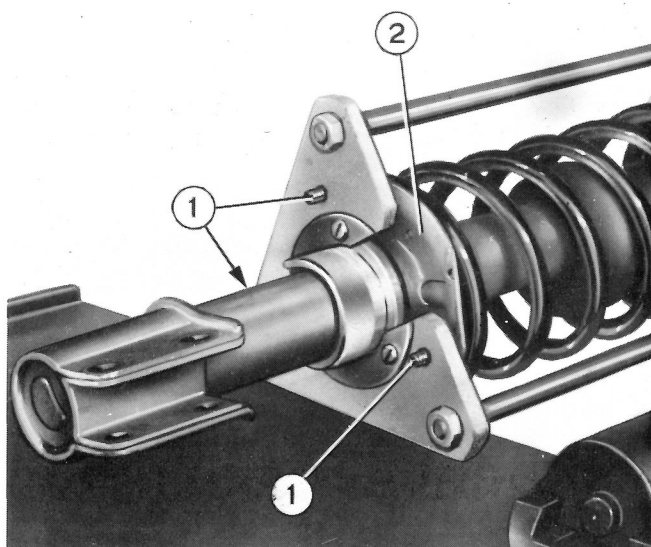


Make sure one bolt at each end of the strut assembly is in the depression used to position the spring on the plate.

Tighten the three bolts (1) on tool A. 74241 until they are touching the spring check plate (2).

Crank fixture A. 74241 until the spring is compressed about one inch.

1. Spring check plate clearance bolts
2. Lower check plate.

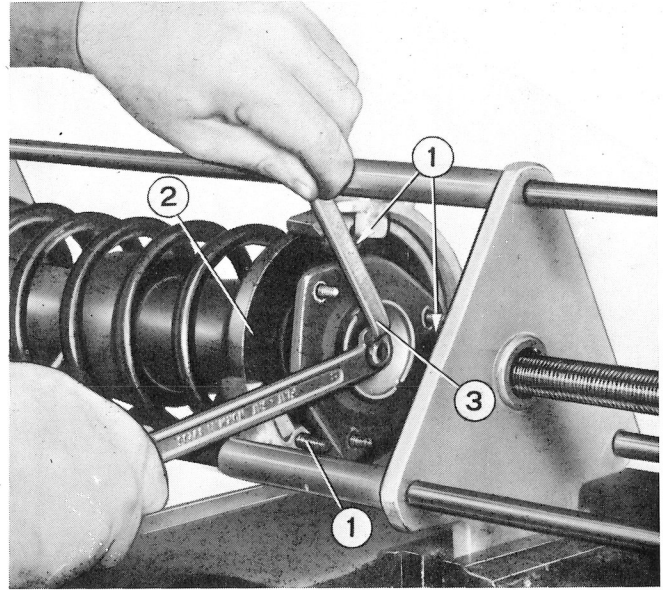


Using wrench A. 57020 (3) to hold the shock absorber shaft, remove the nut holding the upper mount to the shock absorber.

Carefully uncrank fixture A. 74241 until the spring is fully relaxed.

Remove the strut from the fixture and separate the parts.

1. Spring check plate bolts —
2. Upper check plate —
3. Wrench A. 57020.



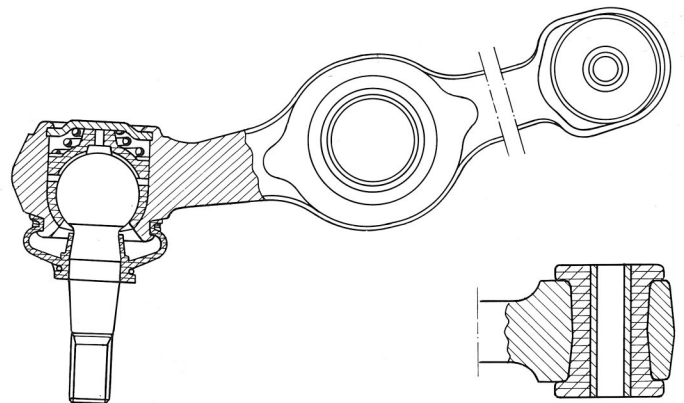
INSPECTION

Control Arms

Check the arms carefully to make sure that they are free from cracks or signs of distortion. Replace if necessary.

Check the ball joint for excess play. Check the swivels and protection boots for cracks or breaks that might permit moisture or dirt entry. Replace entire control arm if damaged.

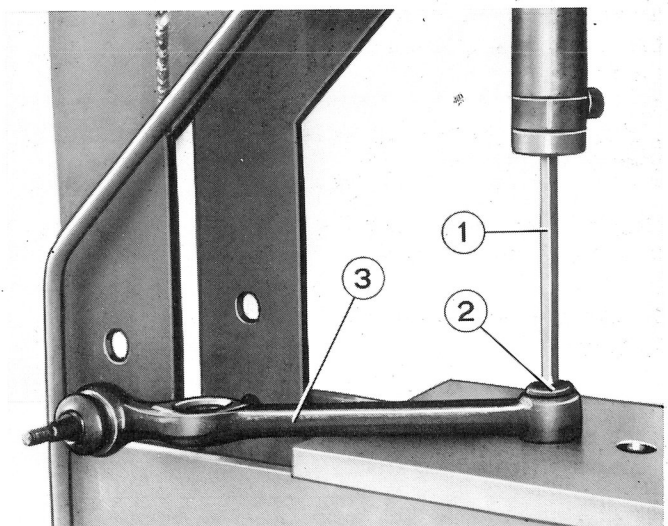
Check rubber bushing for wear or deterioration. Replace if necessary.



Control Arm Bushing Replacement

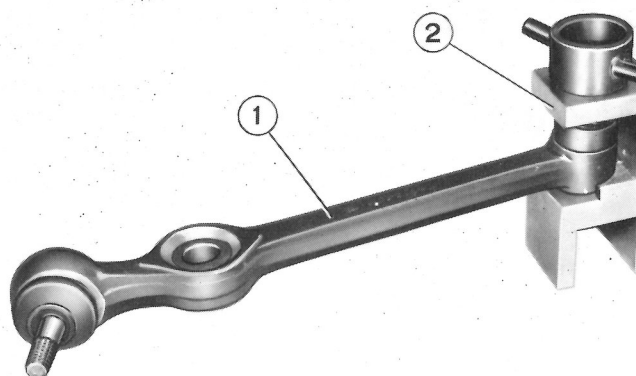
Place the control arm (3) in a press. Using a bushing punch (1), press the bushing (2) out of the control arm.

1. Bushing punch —
2. Bushing —
3. Control arm.



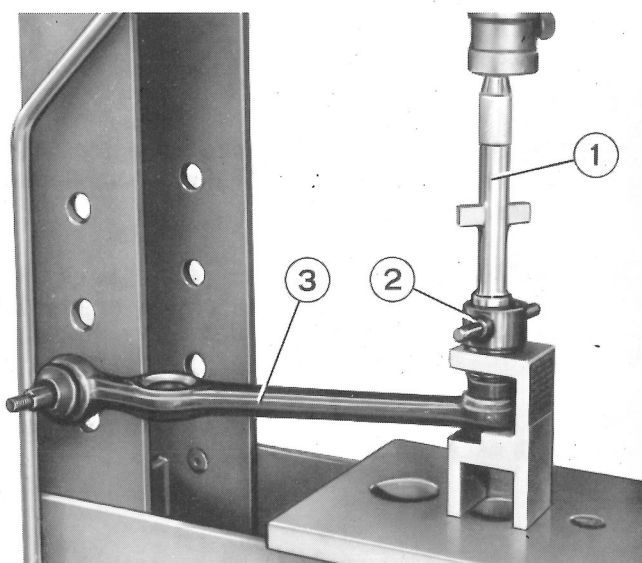
Mount the control arm (1) on tool A. 74271 (2).

1. Control arm
2. Tool A. 74271.

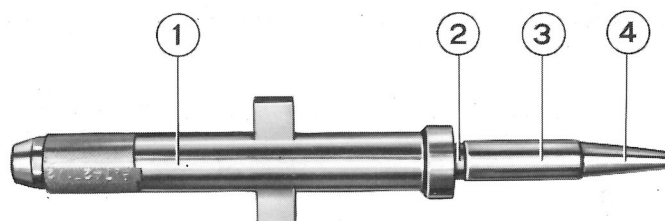


Coat the new bushing with silicone grease. Place bushing on installer of tool A. 74271 and using a press, install the bushing in the control arm. Press the installer down so that the tabs on the installer contact tool part (2).

1. Installer
2. Tool part
3. Control Arm.



Place a new spacer (3) for the bushing on the installer (1) with the tool spacer (2) on the installer. Screw tip (4) on to the installer. Install the spacer (3) in the control arm bushing and remove the tip (4) and then the tool A. 74271.



1. Installer
2. Tool spacer
3. New bushing spacer
4. Tip.

Knuckle

Carefully check the knuckle for cracks. Make sure that the areas of contact with the outer ring of the hub bearing are smooth and free from signs of binding. Replace if damage or wear is observed.

Coil Springs

Check the coils for cracks or distortion. Check the spring performance against the specifications. Replace if necessary. Check the support plates for condition and replace if necessary.

Shock Absorber

Check shock absorber for leaks and performance against the specifications. Replace if necessary.

Sway Bar

Check the sway bar for cracks or distortion. Check the mounting pads and rubber bushings for wear.

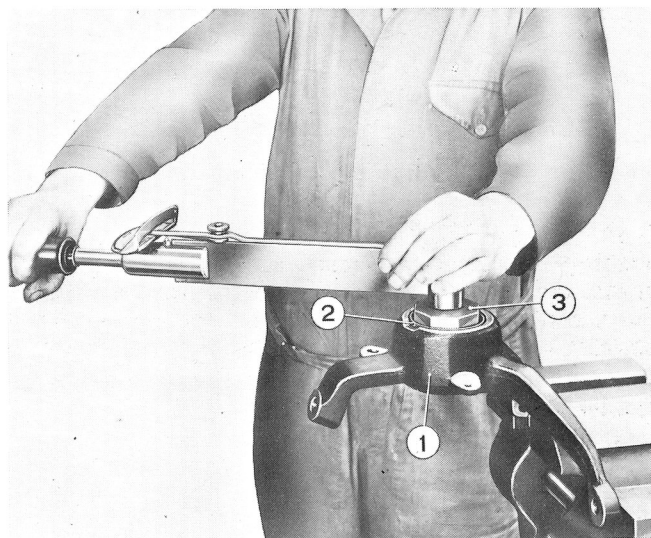
Replace if necessary.

REASSEMBLY

Press the bearing into the knuckle (1) until seated. Screw the octagonal locking into the threaded section (2) and torque to 159 ft. lbs. (216NM) with tool A-57123 (3).

NOTE: The bearing must be replaced each time the wheel hub is disassembled.

1. Knuckle piilar.
2. Ring nut
3. Tool A. 57123



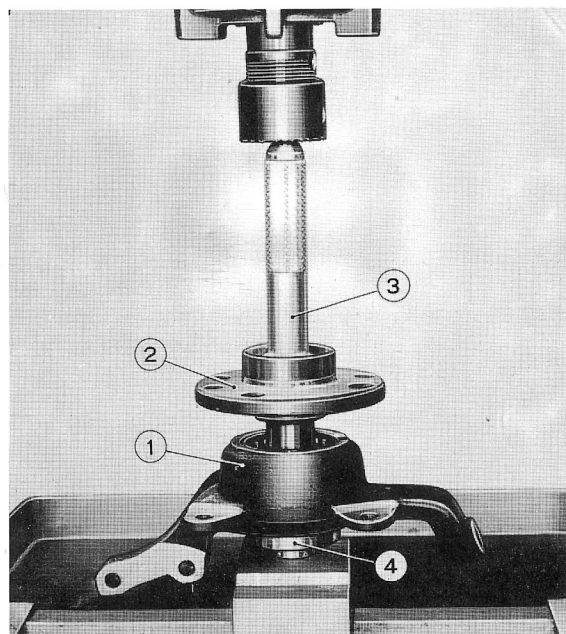
Place the hub (2) in the knuckle (1). Using tool A. 74216 and a press, install the hub in the knuckle.

Install the control arm on the knuckle and secure the ball joint to the knuckle with the nut. Torque the nut to 58 ft. lbs. (78 Nm).

Install the brake disc on the hub with the locator pin and bolt.

Reassemble the shock absorber and coil spring using tool A. 74241. Mount the strut assembly on the knuckle with the two bolts and nuts. Do not tighten the bolts.

1. Knuckle
2. Hub
3. Driver
4. Tool A. 74216



INSTALLATION

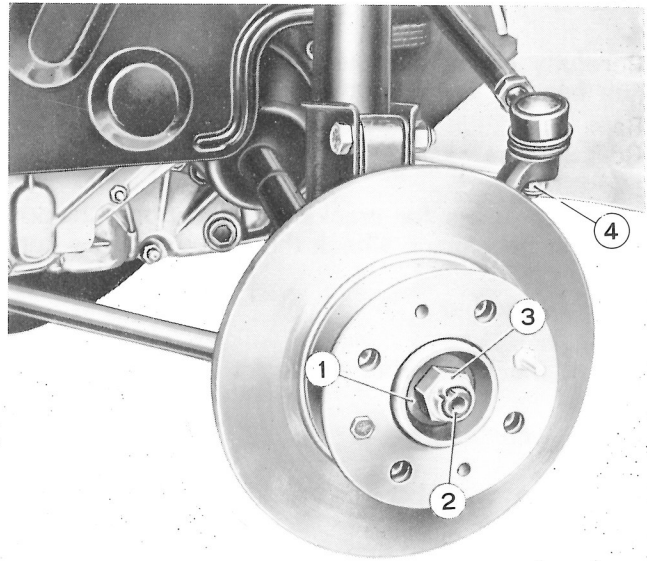
If removed, install the sway bar.

Position the studs on top of the strut assembly through the bolt holes in the engine compartment. Loosely secure the strut assembly with the nuts and washers.

Slide the shaft of the CV joint through the hub. Secure the shaft in the hub with the flat washer and nut.

Attach the tie rod to the steering arm and torque the nut to 25 ft. lbs. (34 Nm).

1. Flat washer
2. CV joint shaft
3. Hub nut
4. Nut



Apply silicone grease to the sway bar bushing in the control arm.

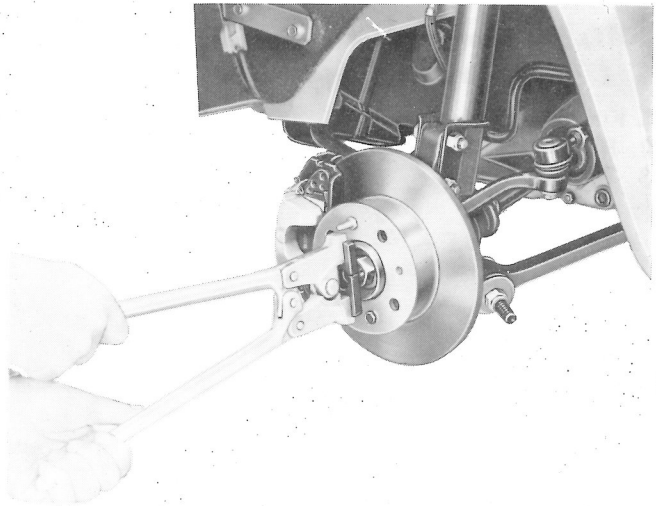
Using as many shims as were removed, loosely attach the sway bar to the control arm with the nut.

Loosely attach the control arm to the bracket on the body with the bolt and nut.

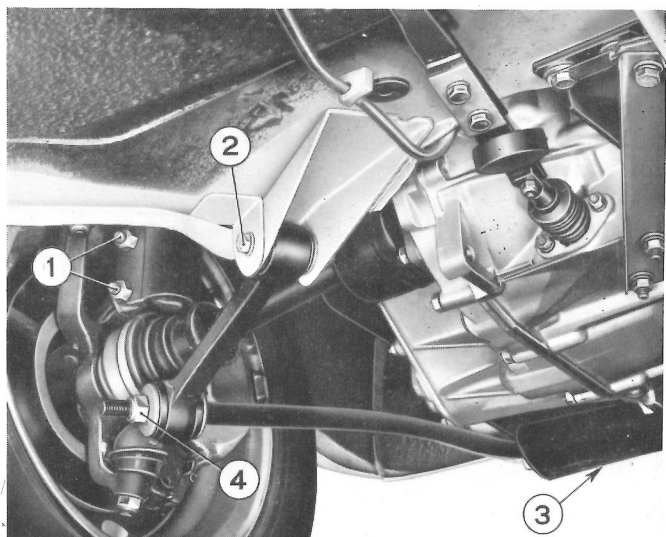
Install the brake caliper and support on the knuckle with the two bolts. Torque to 35 ft. lbs. (47 Nm).

Torque the hub nut to 159 ft. lbs. (216 Nm). Stake the collar of the hub nut using pliers A. 74140/1 and heads A. 74141/9.

Install the wheels and tighten the strut upper mounting nuts in the engine compartment.



NOTE: The attachment bolts and nuts shown in the figure must be torqued to specifications with the suspension under a load equal to 4 passengers plus luggage, or (705 lbs. (320 kg)).



WHEEL HUB

Removal

Raise front of car and remove the wheel.
Remove hub nut (1).

Remove the brake caliper and disc (2 & 3).
Remove two bolts and nuts (4) holding the strut assembly to the knuckle.

Remove the nut (6) holding the control arm to the knuckle. Using tool A. 47038, remove the ball joint from the knuckle.

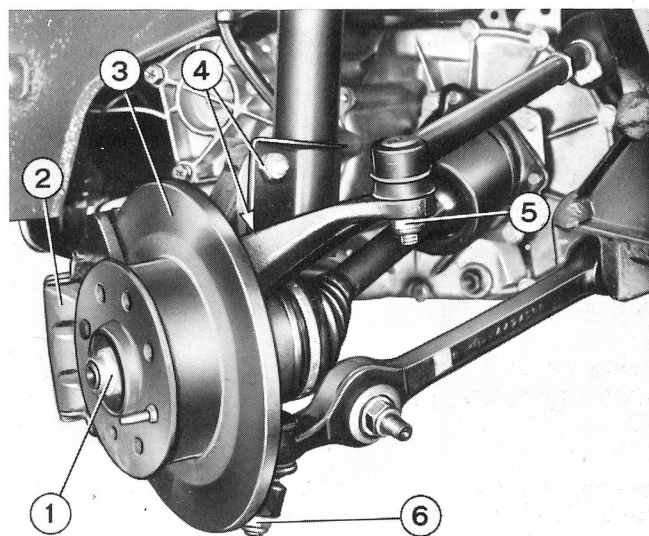
Remove nut (5) holding the tie rod ball joint in the steering arm. Use tool A. 47035 to remove the ball joint.

Slide the knuckle and hub off the CV joint shaft.

INSTALLATION

Install the knuckle in reverse order. Torque the hub nut to 159 ft. lbs. (216 Nm) and then stake the nut. Torque suspension bolts and nuts to specifications under load. See installation of Suspension.

1. Hub nut
2. Brake caliper
3. Brake disc
4. Strut assembly bolts and nuts
5. Tie rod end nut
6. Lower ball joint nut.



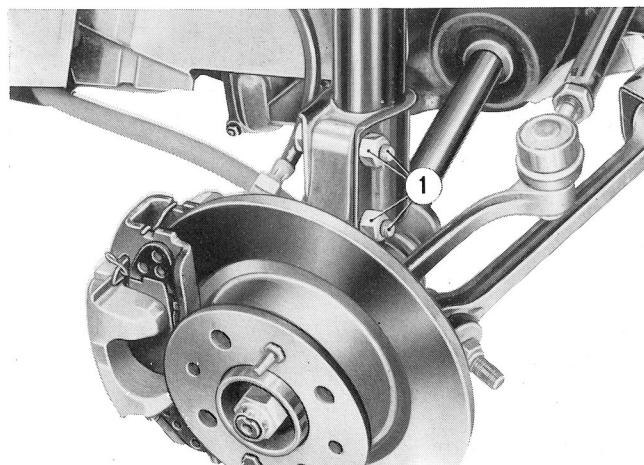
SHOCK ABSORBERS

Removal and Installation

Remove the strut assembly as follows:

Remove the two bolts and nuts (1) holding the strut assembly to the knuckle.

1. Strut assembly bolts and nuts.

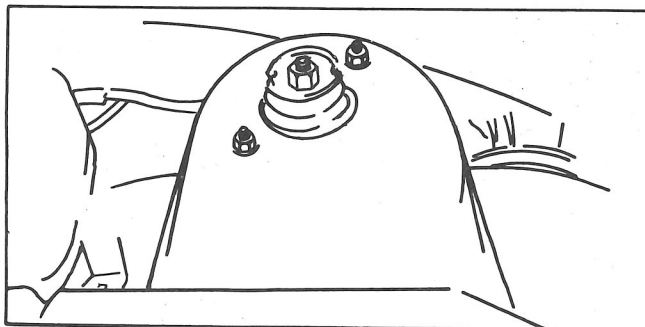


Remove the nuts holding the strut assembly to the body in the engine compartment.

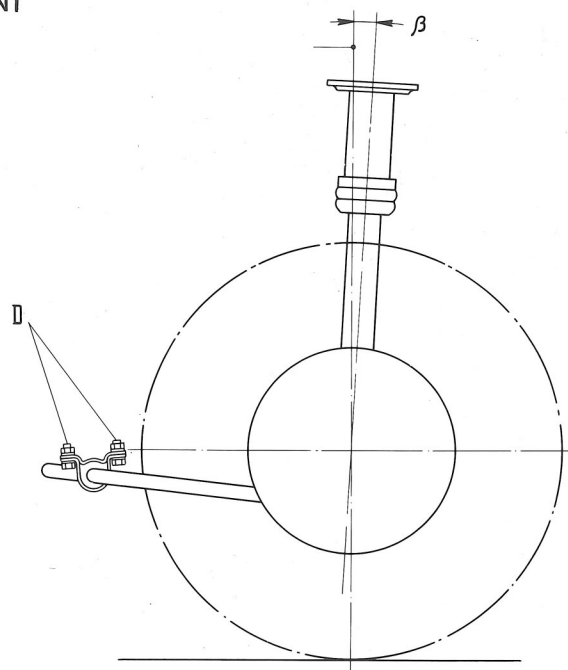
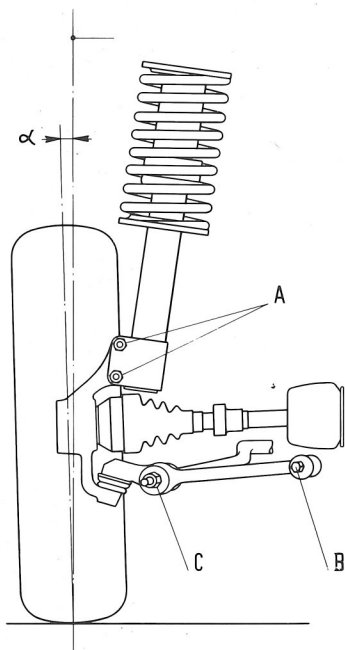
Lower the strut assembly out of the car.

Using fixture A. 74241, remove the coil spring from the shock absorber.

Check the performance of the shock absorber. If shock absorber does not perform according to specifications, replace the shock absorber and top mount.

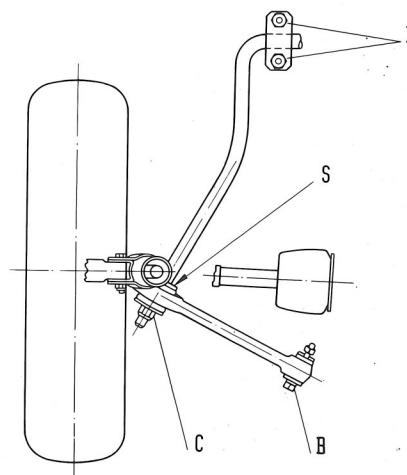


FRONT SUSPENSION ALIGNMENT

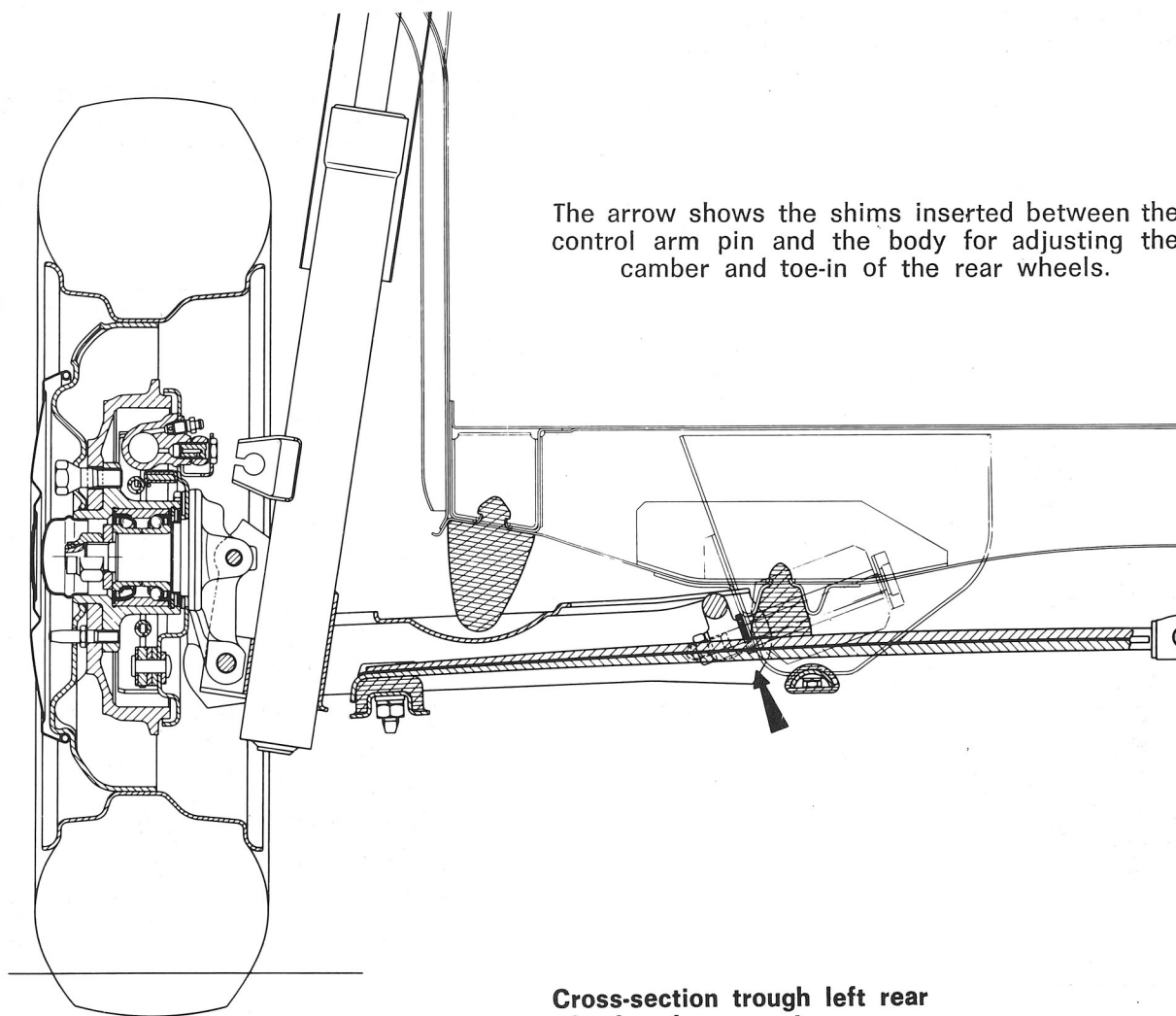


- A. Strut lower mount bolt/nut
- B. Control arm bolt/nut at body
- C. Sway bar nut at control arm
- D. Sway bar bracket bolt/nut
- S. Caster/camber adjustment shims

α . Camber angle
 β . Caster angle



REAR SUSPENSION



REMOVAL

To remove the rear suspension assembly from the vehicle, proceed as follows:

- jack up the rear of the vehicle and support on stands;
- remove the rear wheels;
- plug the outlet hole of the brake fluid reservoir;
- detach the flex hose from the metal pipe;
- release the hand brake and detach the cable from the levers on the brake backing plate;
- disconnect the brake compensator bar from the right control arm;
- place a hydraulic jack under the control arm, raise the suspension and detach the shock absorber in the baggage compartment; remove the jack;
- detach the rubber pads (4) attaching the leaf spring to the control arms;
- unscrew the nuts (1) that attach the swivels of the control arms to the body.
- slide off the control arms, complete with shock absorbers.

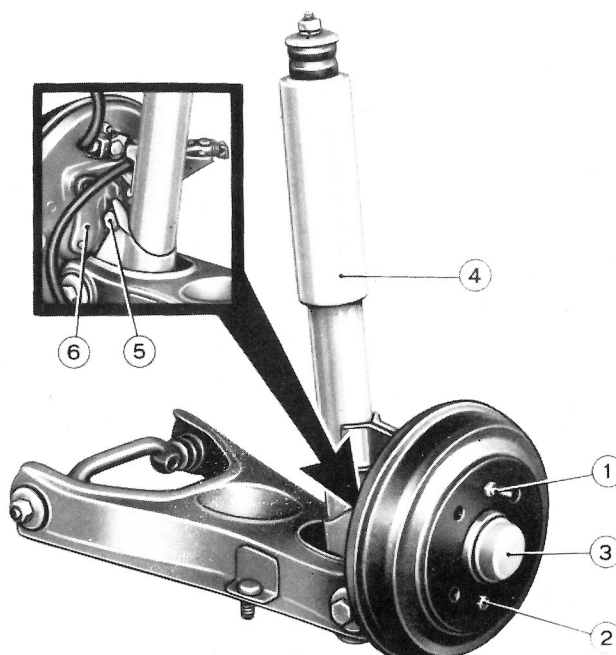
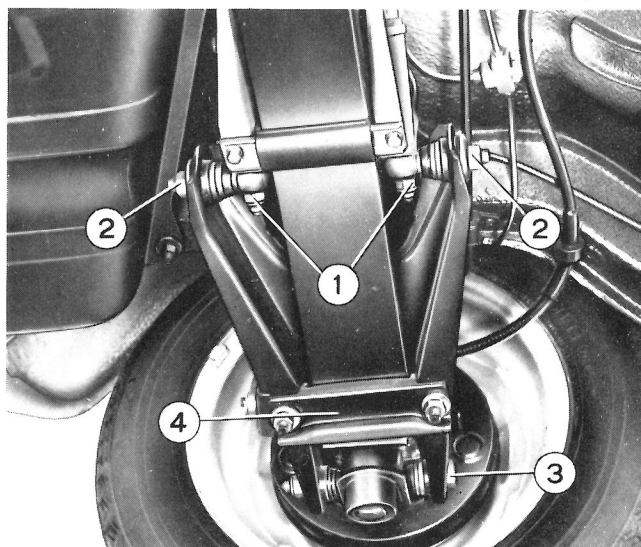
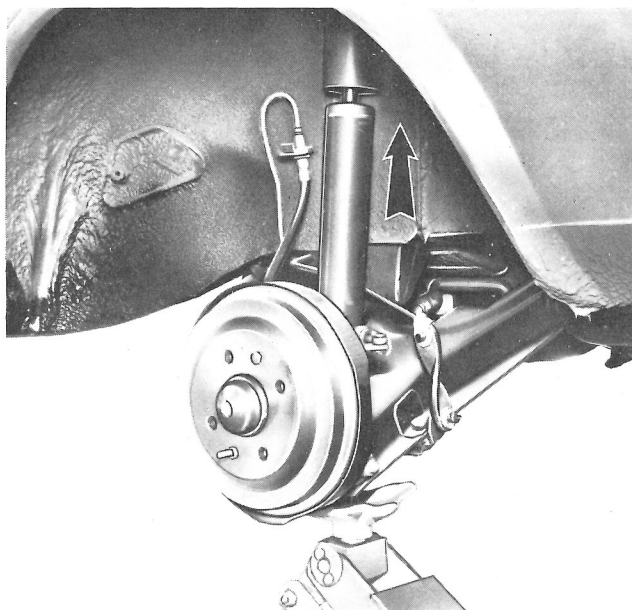
1. Control arm mount nuts
2. Control arm pivot pin nuts
3. Control arm/stub axle bolt
4. Spring anchor

DISASSEMBLY

The control arms are dismantled on the bench as follows:

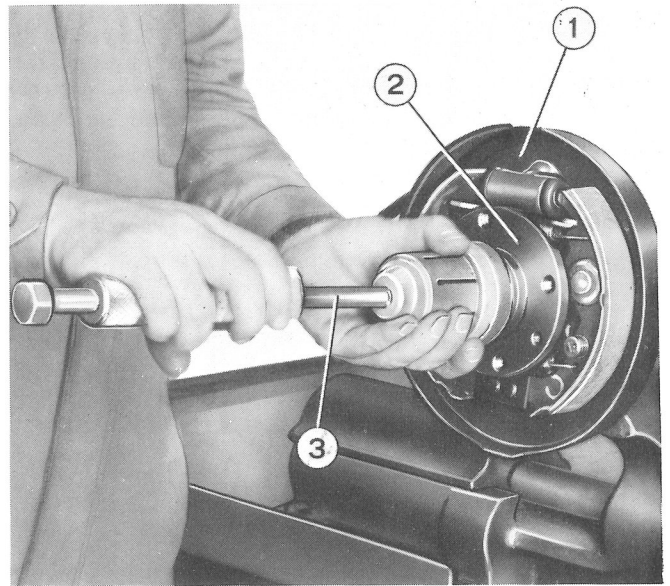
- remove the nut attaching the shock absorber and control arm to the stub axle and slip off the screw (3) and the control arm. Make a note of the number and thickness of the shims;
- remove the nut attaching the shock absorber to the stub axle and slide off the screw (5) and the shock absorber;
- remove the brake drum by unscrewing the wheel centering stud and the drum attachment screw (1 and 2).

1. Wheel centering stud
2. Drum attachment screw
3. Hub cap
4. Shock absorber
5. Screw attaching shock absorber stub axle
6. Stub axle



- use A. 47014 tool to remove the hub cap;
- unscrew the nut attaching the hub to the stub axle and take off the washer;

1. Backing plate
2. Hub
3. Tool A. 47014.

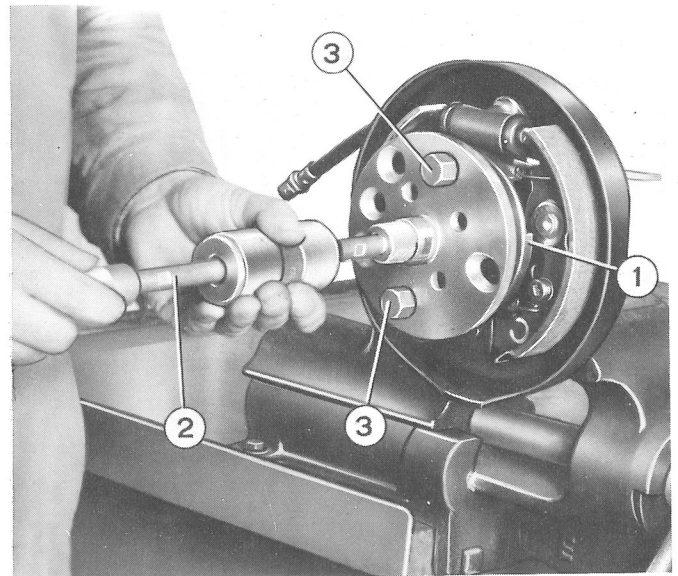


- use A. 47017 tool to remove the hub, complete with bearing;

- remove the safety plate, unscrew the union attaching the brake hose to the brake cylinder in the section on »Brakes«;

- remove the screws attaching the brake backing plate to the stub axle and take off the backing plate.

1. Hub
2. Tool A. 47017
3. Screw attaching tool to hub.



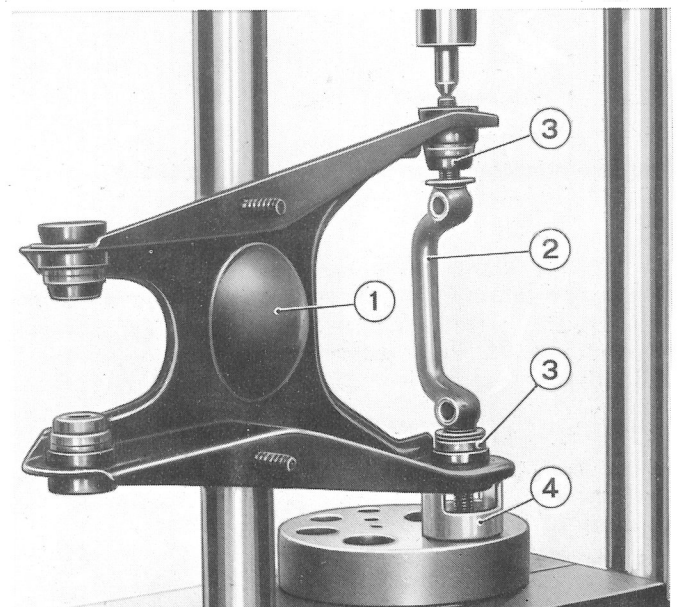
Inspection and Overhaul

Check the control arms for distortion and replace if necessary.

Check the condition of the rubber bushings inserted in the arms. The inside surface should not show friction marks with the pin; if the rubber part of the bushing is worn or not fully flexible, the bushing must be replaced; for procedure, see below.

Remove the nuts attaching the pin to the control arm. Apply an A. 47057 tool (4) to the control arm and use a press to push the pin (2) and free the bushing (3) from its seat in the control arm.

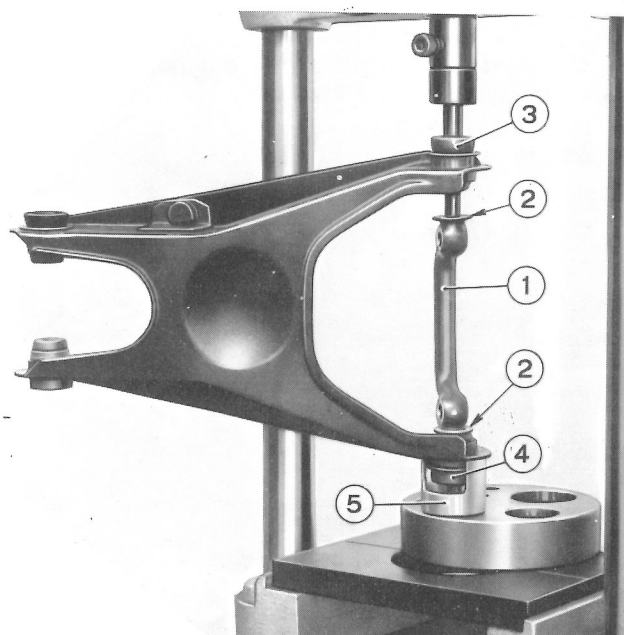
1. Control arm
2. Pin
3. Rubber bushing
4. Tool A. 47057.



NOTE: The first bushing should be only partly extracted from the control arm, since this will ensure that the pin is properly centered for the removal of the second bushing.

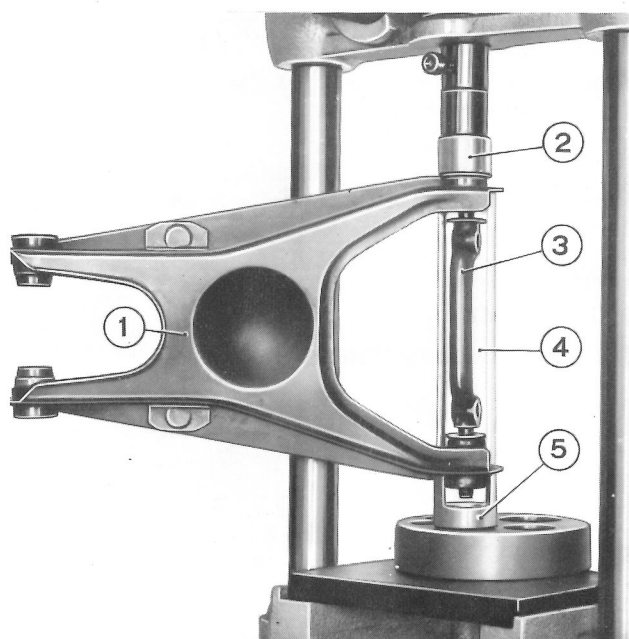
Reverse the arm and repeat these operations to release the other bushing.

1. Pin
2. Washers
3. Front guide bushing
4. Rear Rubber bushing
5. Tool A. 47057



Reassembly of the two bushings requires a press and the employment of tools A. 47057 and A. 74220.

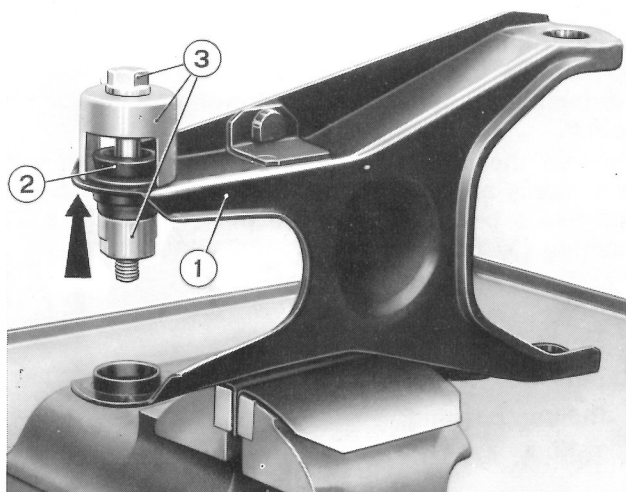
1. Control arm
2. and 5. Tool A. 47057
3. Pin
4. Spacer A. 74220



Tool A. 47057 will be required to extract the rubber bushing from the control arm on the outer end.

To replace these bushings, proceed as follows: insert the bushing in its seat on the control arm and apply A. 47057, complete with cap. The screw on the tool is then turned to force the bushing into place.

1. Control arm
2. Rubber bushing
3. Tool A. 47057



REASSEMBLY

Following inspection and overhaul of the rear suspension its various components are reassembled as follows.

Attach the backing plate to the stub axle by means of the four bolts and tighten with a torque of 18,5 Ft. lb. (25 Nm).

Install the wheel cylinder to the backing plate and mount the shoes as described in the section on »Brakes«.

1. Stub axle
2. Backing plate bolt
3. Backing plate
4. Torque wrench

Assemble the complete hub on the stub axle. Insert the washer and screw down the attachment nut with a torque of 159 Ft. lb. (216 Nm). Stake the collar of the nut with A. 74140/1 pliers fitted with a pair of A. 74140/9 heads.

Rub the brake drum surface with emery cloth and reassemble. Then use an A. 74088 driver to apply the hub cap.

1. Tool A. 74140/1/3
2. Nut
3. Hub

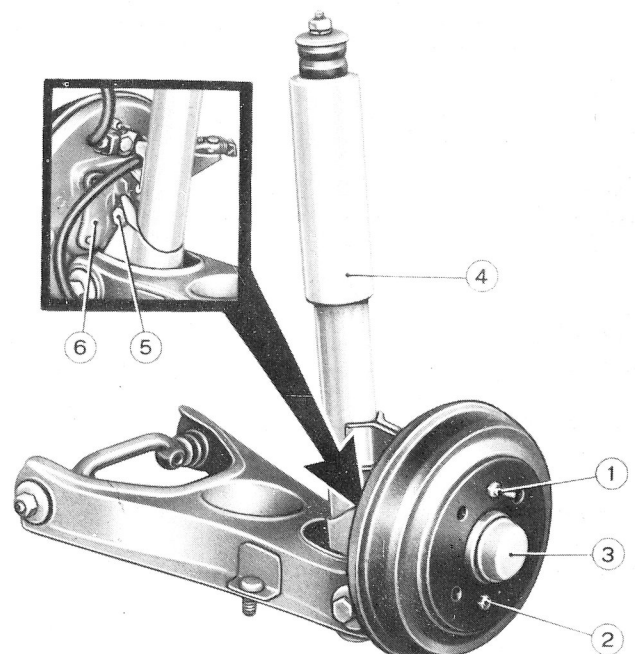
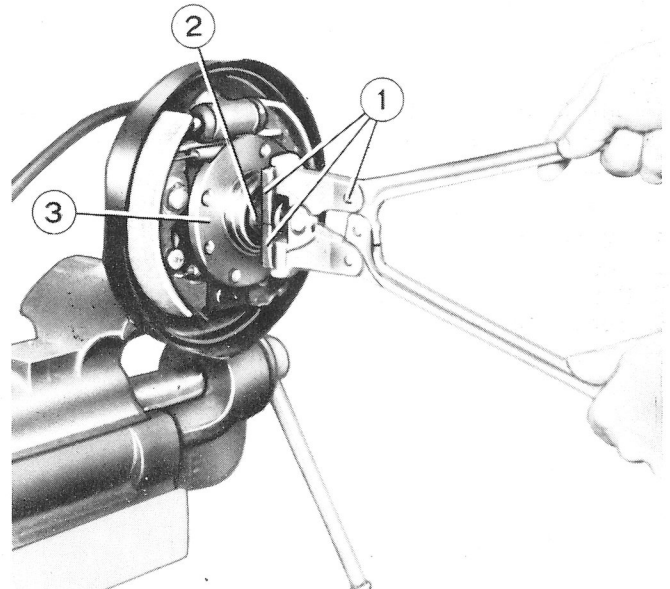
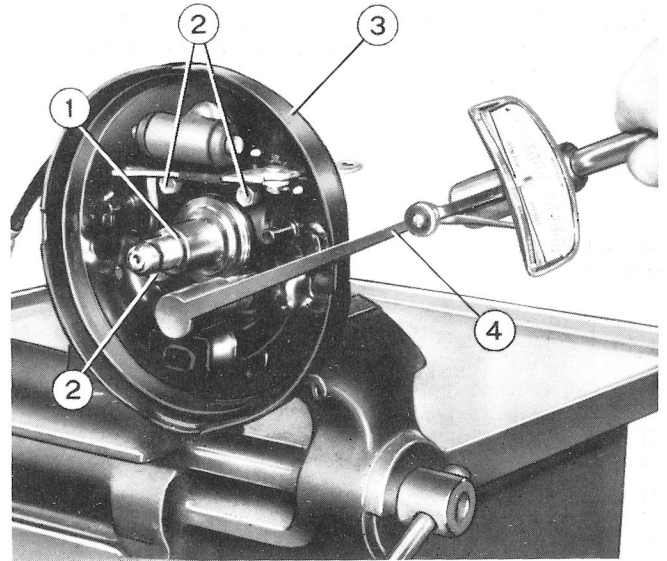
Connect the bottom end of the shock absorber to the stub axle and the control arm. Shims must be inserted between the bushings and the shock absorber mounting bracket.

Loosely mount the self-locking nut.

Tighten the upper nut attaching the shock absorber to the spindle with a torque of 43 Ft. lb. (59 Nm).

Reconnect the brake fluid pipe to the wheel cylinder and attach with the plate and screw.

1. Drum attachment and wheel centering stud
2. Drum attachment screw
3. Hub cap
4. Shock absorber
5. Bolt attaching shock absorber to wheel spindle
6. Stub axle



Attach the control arm to the body over the two studs protruding through the plate and screw down the nuts hand tight.

Reattach the rubber pads used to anchor the leaf spring.

Attach the bar of the brake pressure regulator to the right control arm.

Slip the bottom rubber bushing on the top stud of the shock absorber. Apply a hydraulic jack under the suspension and lift the whole assembly so as to enable the top stud of the shock absorber to be inserted in the body.

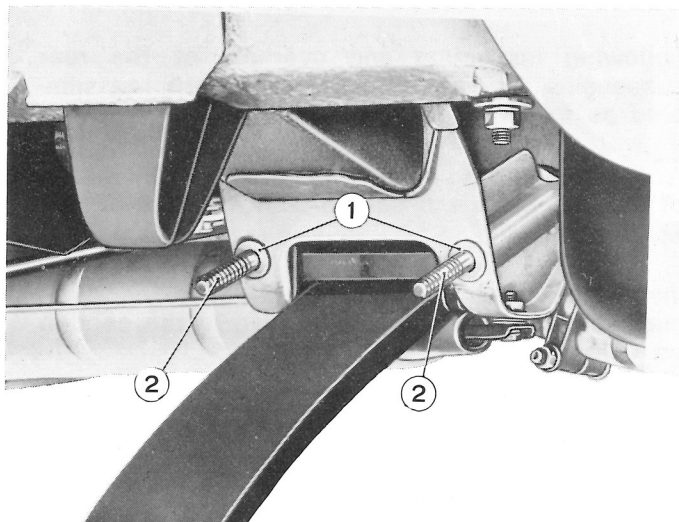
Mount the top rubber bushing, the retainer cap and the self-locking nut on the top stud of the shock absorber.

Lock the shaft of the shock absorber with an A. 57020 wrench and tighten the nut.

Reattach the hand brake control cable to the lever on the backing plate and reconnect the brake fluid hose and metal pipe to each other.

Refill the brake fluid reservoir and bleed the system.

Remount the wheels and lower the vehicle.



1. Adjustment shims
2. Studs attaching control arm pin to body

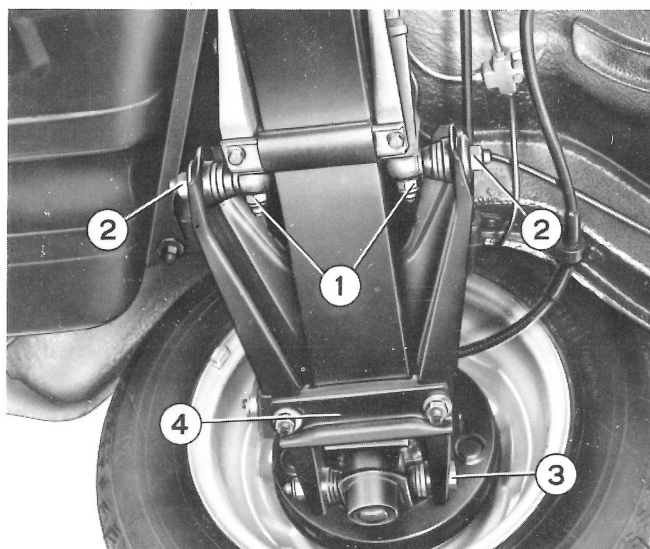
TIGHTENING THE RUBBER BUSHINGS

The nuts of the rubber bushings must be tightened with the vehicle loaded so as to prevent them from rapid wear.

Set the wheels straight ahead and load the vehicle to the equivalent of 4 persons plus luggage, about 705 lb. (320 kg.).

Then tighten the nuts with the following torque values;

Control arm mount nuts (1): 36 ft. lb. (49 Nm)
 Control arm pivot pin nuts (2): 36 ft. lb. (49 Nm)
 Control arm/stub axle bolt (3): 58 ft. lb. (78 Nm)
 Spring anchor (4): 22 ft. lb. (29 Nm)



LEAF SPRING

To remove the leaf spring from the vehicle, proceed as follows:

- take off the rear wheels;
- use the jack to raise the left end of the spring and free the anchor pad on control arm;

Repeat the operation described above to free the other end of the spring.

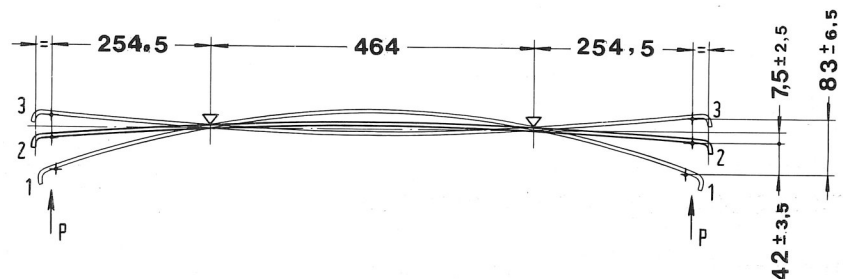
Take off the two guides holding the spring to the body and remove the spring.

The following checks are now carried out:

- make sure that the leaves are neither cracked nor broken and replace if necessary;
- make sure that the contact surfaces of the leaves are perfectly smooth;
- check the camber of the leaves and obtain the correct values, if necessary;
- check rubber pads and replace if worn.

Remount the spring in the reverse order.

Leaf spring test data



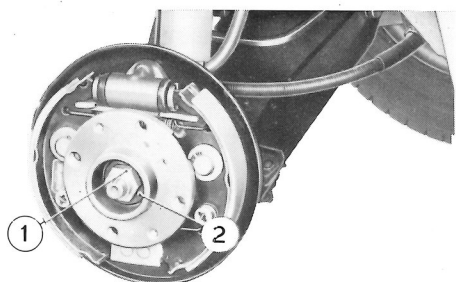
in	mm
.295 ± .098	7,5 ± 2,5
1.654 ± .139	42,0 ± 3,5
3.268 ± .256	83,0 ± 6,5
10.000	254,5
18.268	464,0

WHEEL HUBS

DISASSEMBLY

Replacement of the rear wheel hubs is carried out as follows:

- jack up the rear of the vehicle and rest it on stands.
- remove the wheels;
- use an A. 47014 tool to remove the hub cap
- unscrew the wheel centering stud and the screw and take off the brake drum;
- unscrew the nut attaching the hub to the spindle;



View of wheel hub on spindle

1. Hub attachment nut
2. Washer.

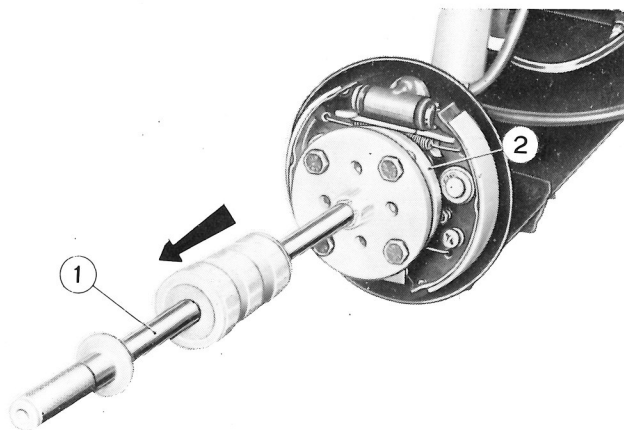
- slide off the washer and remove the entire hub with the aid of an A. 47017 puller.

NOTE: Rear wheel hubs are supplied for service complete with bearings, which means that the whole assembly must be replaced when overhauling the unit.

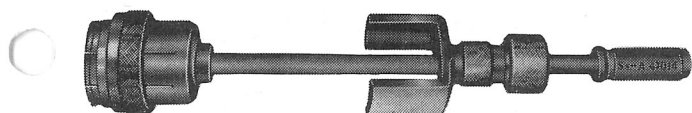
REMOVAL OF WHEEL HUB

1. A. 47017 puller nut
2. Wheel hub.

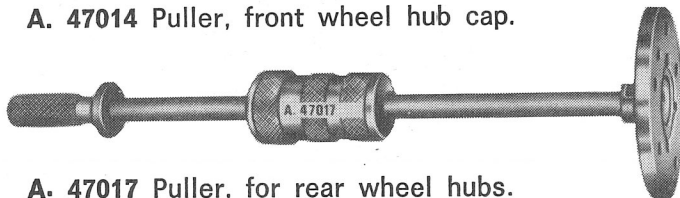
To reassemble, reverse the procedure.



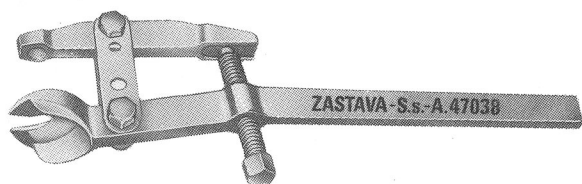
Service tools



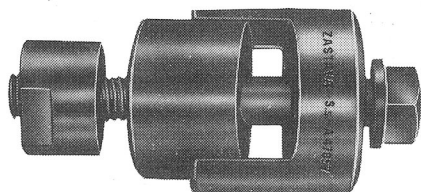
A. 47014 Puller, front wheel hub cap.



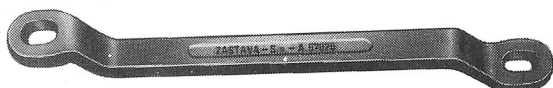
A. 47017 Puller, for rear wheel hubs.



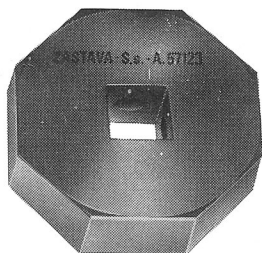
A. 47038 Puller, ball joint.



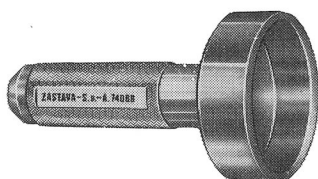
A. 47057 Remover and installer, bushing on rear suspension swinging arm



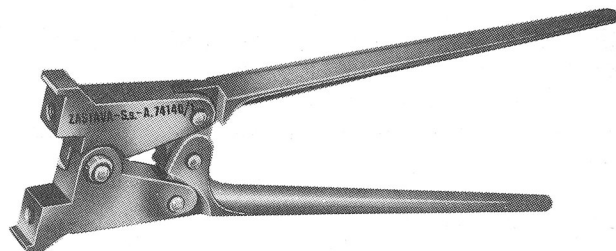
A. 57020 Spanner for holding shock absorber.



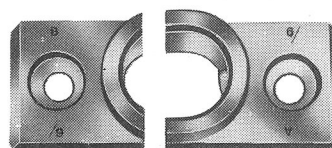
A. 57123 Wrench, front wheel bearing ring nut.



A. 74088 Installer, front wheel hub cap.



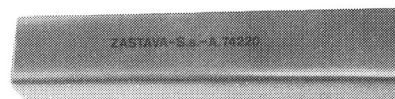
A. 74140/1 Tool, wheel hub nut staking, w/o heads.



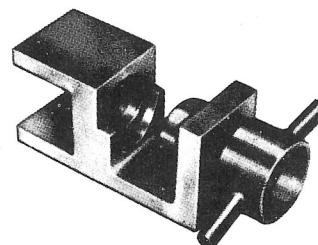
A. 74140/9 Heads (pair), front and rear wheel hub nut staking (to be used with tool A. 74140 1).



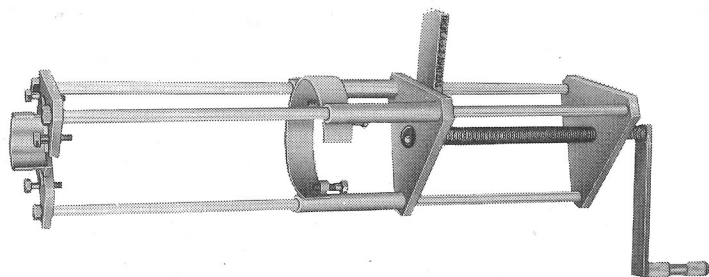
A. 74216 Tool for removing and refitting front wheel bearing and hub to support (use with press or with A. 40005/002).



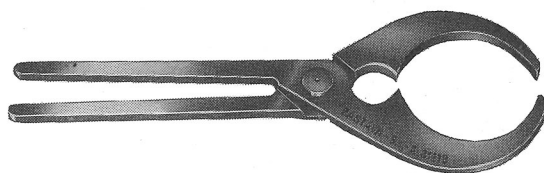
A. 74220 Spacer, installation of rear-suspension swinging arm inner resilient bushings (use with workshop press).



A. 74271 Installer, front suspensions control arms resilient bushings (use with workshop press).



A. 74241 Tool, front suspension coil springs compression.



A. 81118 Tool, for front wheel constant velocity joint boot collar installation.

ELECTRICAL SYSTEM

ELECTRICAL SYSTEM

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SPECIFICATIONS	7-1
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CHARGING SYSTEM	7-2
STARTING SYSTEM	7-6
IGNITION	7-10
LIGHTING	7-15
INSTRUMENTS AND CONTROLS	7-16
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BATTERY

SPECIFICATIONS

Nominal voltage	12 Volt
Nominal capacity (at 20 h discharge rate)	45 amp/hour
Cold cranking capacity (at 0°F — 18°C)	370 Amps
Length	9.45 in. (214 mm)
Width	6.85 in. (164.5 mm)
Height (terminals included)	6.89 in. (192 mm)

INSPECTION AND MAINTENANCE

The battery should be kept clean and dry, particularly on top.

Scrub with a stiff bristle brush, being careful to prevent dirt or dust from getting into the cells.

Visually inspect cell covers for cracks which might result in leakage.

Electrolyte losses through spilling or leaking should be carefully prevented, as the electrolyte attacks the parts it contacts.

If leakage and corrosion has already occurred, scrub clean and coat any parts affected that are still serviceable with acid-proof paint; otherwise, replace them.

Appropriate wrenches should be used to loosen or tighten terminal nuts. Nevers use pliers for this operation.

Avoid striking terminals with a hammer to facilitate installation on or removal from battery posts.

An appropriate tool should always be used to cause a terminal to turn on the post in order to loosen it. Do not attempt to do this by pulling on the cable, as cracks in the cell cover or the post breaking loose might occur, with resultant leakages of electrolyte.

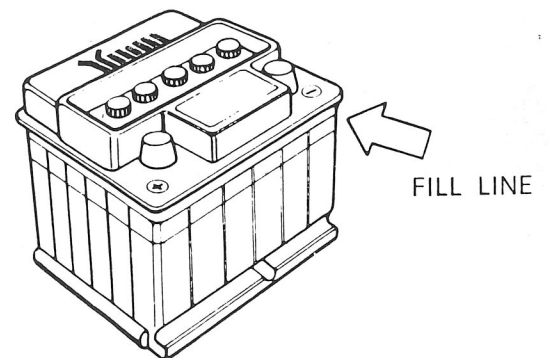
Terminals and posts should be coated with pure vaseline.

Checking Electrolyte Level

Water is the only element subject to evaporation and requiring periodic refilling.

When the electrolyte level is low, distilled, add water only; never add acid.

Electrolyte should cover separators at all times, but should not exceed the specified level.



A battery cell is correctly topped up when the electrolyte is flush with the sight hole, or when it meets the line on the case (arrow above).

Fillers are also provided with vent slots for electrolyte vapors.

Check electrolyte level every 3000 miles, or every other week if the vehicle is not being used.

Testing State of Charge

The electrolyte specific gravity (see table below) is correlated to the state of charge of the battery.

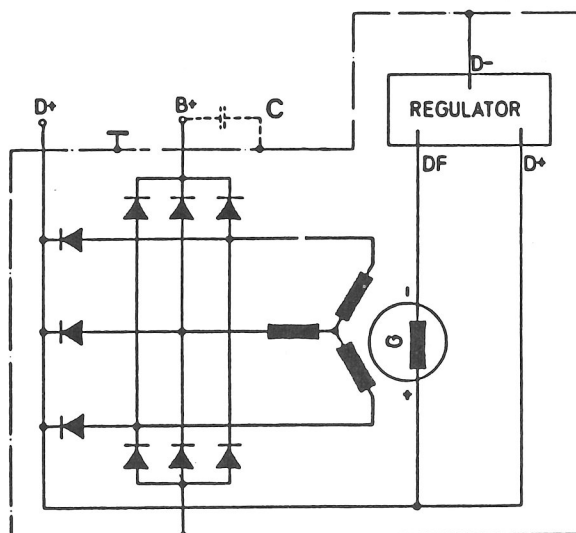
Specific gravity	State of charge
1 280	100%
1 250	75%
1 220	50%
1 190	25%
1 160	nearly discharged
1 110	discharged

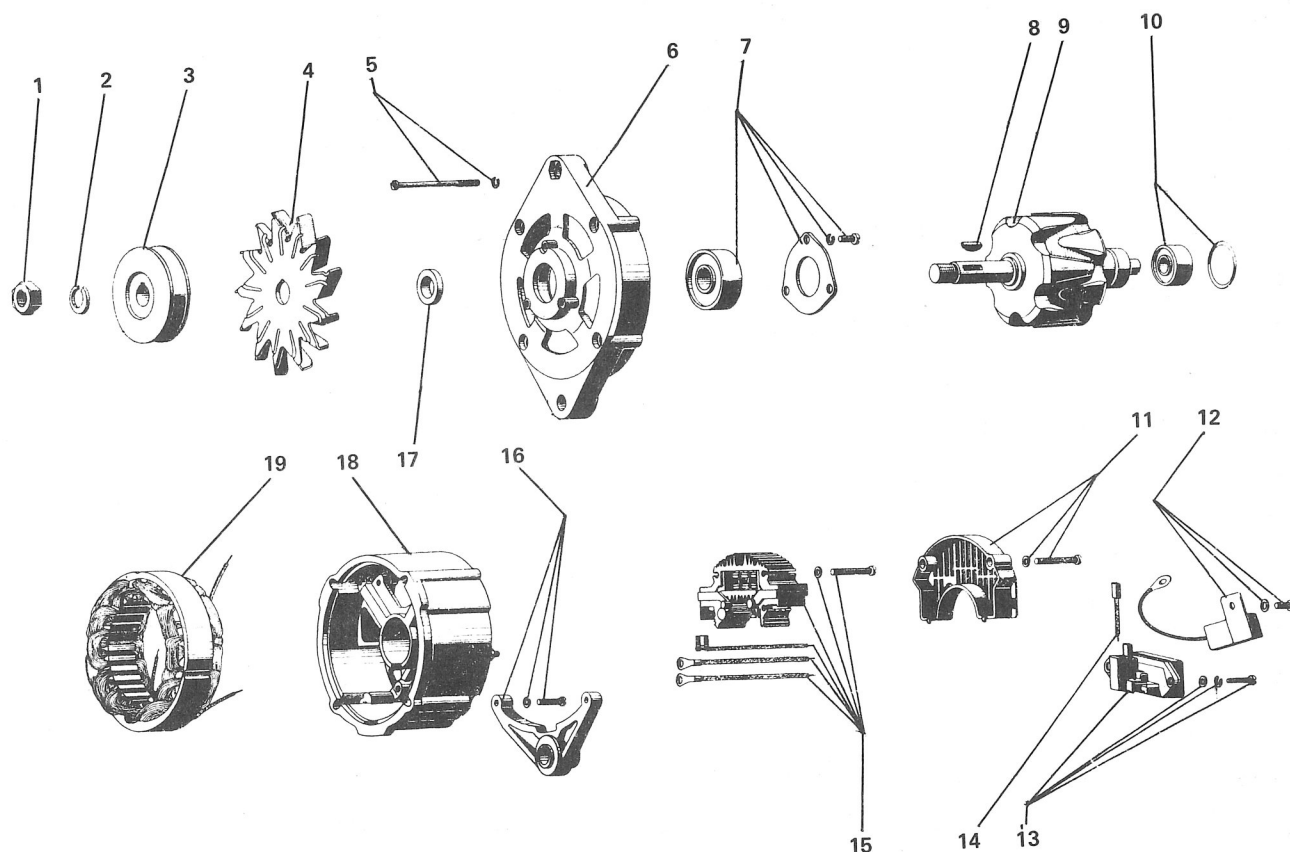
ALTERNATOR YUGO 55

SPECIFICATION

Type, Iskra	AAK 1163
Nominal voltage	14 V
Nominal current	≥ 55 A
Cut-in speed, at $I=0$ A, $U=13$ V, $T=(20^{\circ}\text{C})$ 293 K	≤ 1100 r.p.m.
Current output at 13 V on battery, at 6000 r.p.m. and at operational temperature, not less than	54 A
Max. steady speed	13.000 r.p.m.
Rotor winding resistance, at 293 K (20°C): — between slip rings	$3,4 \pm 0,35$ ohm
Voltage Regulator	Iskra AER 1505 14 V
Make and Type	Electronic integral with alternater
Alternator speed for regulator test and adjustment	4500 ± 100 r.p.m.

Diagram of alternator inside wiring





Exploded view of Iskra Alternator

- | | | |
|---------------------------------------|-------------------------------------|-----------------|
| 1. Nut | 8. Key | 14. Brush |
| 2. Spring washer | 9. Rotor | 15. Rectifier |
| 3. Pulley | 10. Bearing and backing washer | 16. Support |
| 4. Fan | 11. Rectifier cover | 17. Thrust ring |
| 5. Through-bolt | 12. Radio suppressor | 18. Rear frame |
| 6. Drive end housing | 13. Voltage regulator, with brushes | 19. Stator |
| 7. Bearing and bearing retainer plate | | |

DISASSEMBLY AND REASSEMBLY

Disconnect electrical plug and remove screw and lockwasher to remove suppressor (12).

Remove two screws to remove voltage regulator (13).

Remove nut to remove pulley (3), fan (4), spacers, and key (8).

Remove four long screws to separate front frame from rear frame (18).

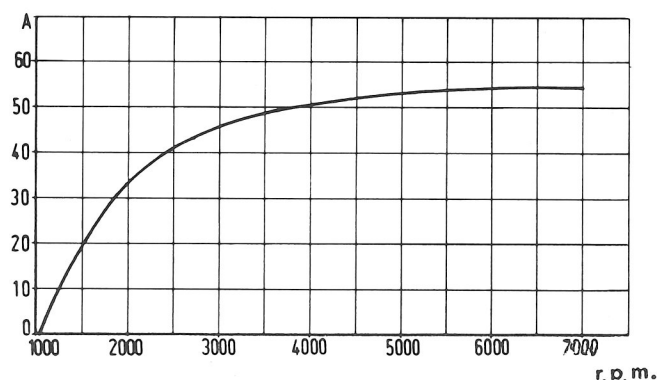
Remove rotor assembly (9) from rear frame by pulling rotor out.

Remove stator assembly (19) and rectifier assembly (15) as a unit by removing three screws. Remove three stator wires from rectifier to separate rectifier.

Reassemble in reverse order of disassembly.

Iskra alternator: minimum output curve at rated temperature, steady voltage 14 V.

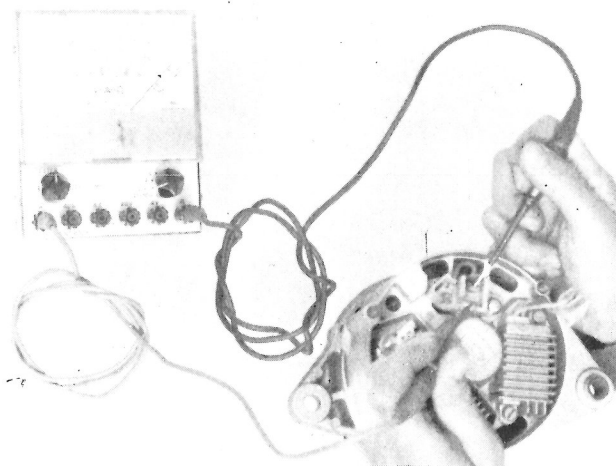
If the complete alternator checks show no output, inspect the initial charging rate and the current obtained on a test bench. If the values so indicated are not within specified limits then inspect the alternator components.



Rotor Winding

Remove the voltage regulator from the alternator and position the ohmmeter probes on the rotor slip rings. (The instrument should be set for ohm readings). The instrument should indicate a resistance value. No resistance means that the rotor is open.

Also inspect the winding insulation relative to ground. When the test leads are connected between ground and the slip rings, no continuity must be recorded.



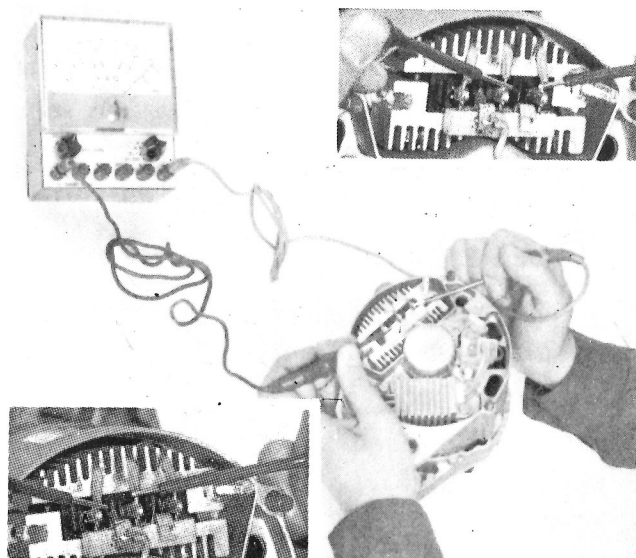
Stator

Resistance recorded at 68°F (20°C) should be equivalent to values shown in Table.

Inspection of short circuit of each stator winding: Connect ohmmeter to stator leads in the three ways possible.

One lead in the alternator stator may be open due to the fact that the resistance reading during one measurement is approximately zero while resistance is much higher in the subsequent two measurements.

Also inspect the winding insulation relative to the stator ground. When the instrument test leads are connected between ground and each lead no current flow must be recorded.

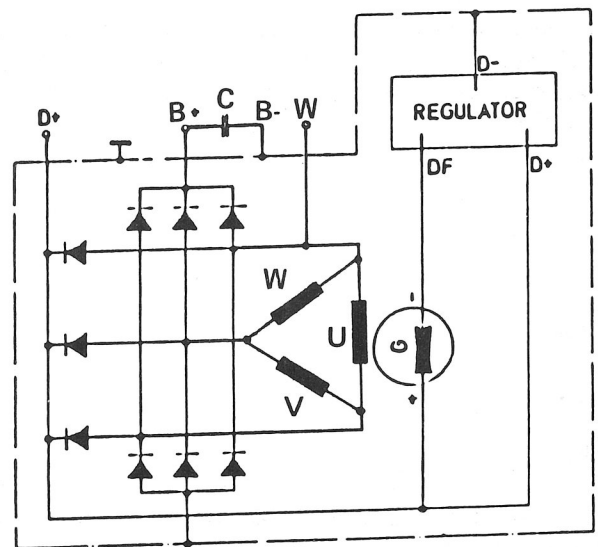


ALTERNATOR YUGO 65

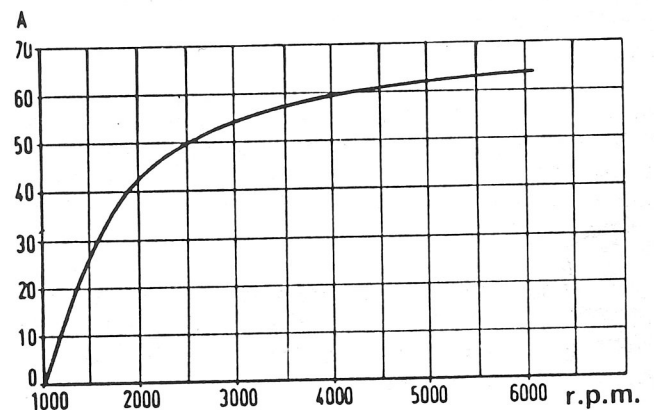
SPECIFICATION

Type, Iskra	AAK 1173
Nominal voltage	14 V
Nominal current	65 A
Cut-in speed, at $I=0A$, $U=13V$, $T=(20^{\circ}C)$ 293 K	≤ 1100 r.p.m.
Current output at 13 V on battery, at 6000 r.p.m. and at operational temperature, not less than	≥ 65 A
Max. steady speed	13.000 r.p.m.
Rotor winding resistance, at 298 K ($20^{\circ}C$): — between slip rings	$2,7 \pm 0,18$ ohm
Voltage Regulator	Iskra AER 1526 14 V
Make and Type	Electronic integral with alternater
Alternator speed for regulator test and adjustment	4500 ± 100 r.p.m.

Diagram of alternator inside wiring



Iskra alternator: minimum output curve at rated temperature, steady voltage 13 V.



Bench test

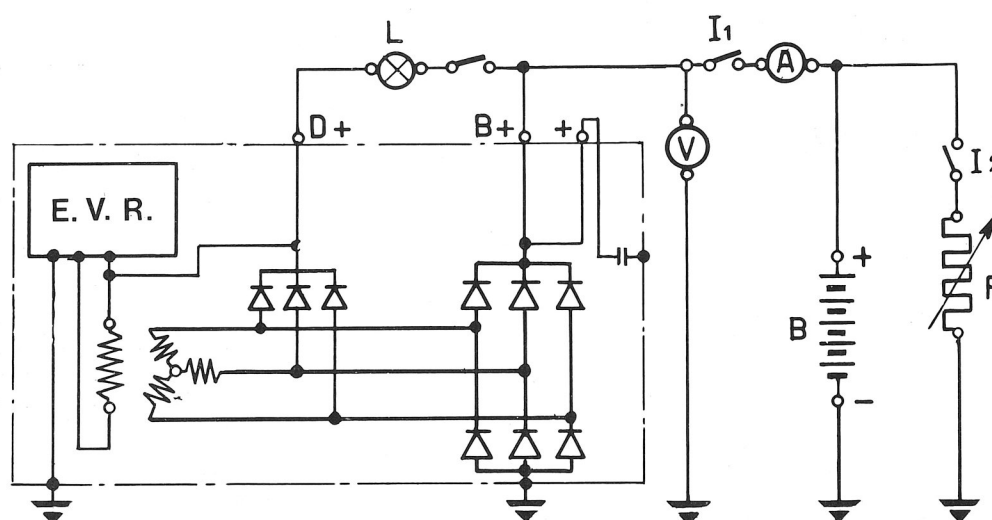
[at ambient temperature 68 to 86°F (20 to 30°C)]. Install the alternator with its pulley on a test bench as shown on diagram below.

Run alternator and set the speed so that current of 1 to 3 A is obtained with I_2 switch opened. After a few minutes of running open I_1 switch and set the speed until the voltage of 13,65 to 14 V is obtained.

The value of the last speed should match the initial charging rate value according to the current curve provided by the alternator being tested.

To check the alternator output allow it to run for 15 min at the speed of 6000 r.p.m. and using the voltage of 14 V and the alternator running at a thermal stabilization rate check whether the current so obtained matches the current curve provided by the alternator being tested.

This measurement should be made with I_1 and I_2 switches closed and by properly adjusting the rheostat value (R).



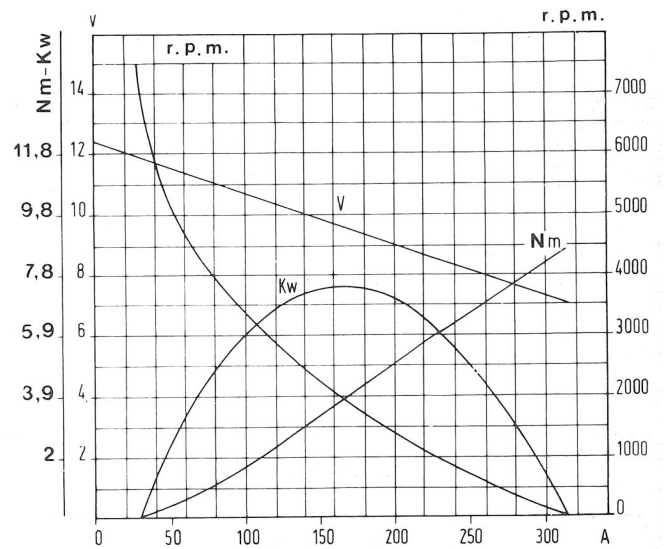
Alternator wiring diagram when testing the initial charging rate and current

- | | |
|--------------|---------------------------------------|
| A. Ammeter | I_2 Switch |
| V. Voltmeter | L. Warning light |
| R. Rheostat | B + Battery wire connection |
| B. Battery | D + Charge indicator light connection |
| I_1 Switch | |

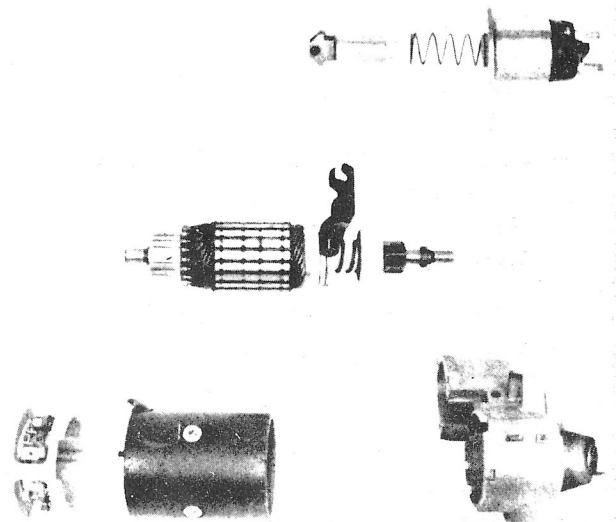
STARTER**SPECIFICATIONS**

Type Voltage Nominal power Rotation, pinion end No. of poles Field coil Drive	AZE 3502 — 12 V 0,8 kW 12 V 0,8 kW clockwise 4 series overrunning clutch
Inside diameter between poles	{ 2.175 to 2.182 in. (55,25 to 55,42 mm)
Armature outside diameter	{ 2,140 to 2.142 in. (54,35 to 54,40 mm)
Control	by solenoid
Bench Test Data — Running test at 76,7°F (298 K) Current Torque developed Speed Voltage — Stall-torque test at 76,7°F (298 K) Current Voltage Torque developed — No-load test at 76,7°F (298 K) Current Voltage Speed Internal break-away resistance at 76,7°F (298 K)	175 + 5 A 2,8 Ft. lbs. (3,92 Nm) 1600 to 1800 r.p.m. 9,4 V 300 to 330 A 7 to 7,2 V 5.9 Ft. Lb. \geq (8 Nm) 30 to 40 A 11,2 to 11,5 V 6500 to 7500 r.p.m. 0,021 to 0,023 ohm
Mechanical Characteristics Test — Spring pressure on unworn brushes — Armature shaft end play	2.49 to 2.80 Lbs. (11,3 to 12,7 N) .004 to .019 in. (0,1 to 0,5 mm)
— Commutator mica undercut depth	{ .019 to .027 in. (0,5 to 0,7 mm)
— Overrunning clutch efficiency: static torque required to rotate pinion slowly	{ 8.85 to 13.28 Ft. Lb. (12 to 18 Nm)
Lubrication Pinion end and commutator end frame bushings — Armature shaft spiral grooves — Overrunning clutch inside splines	engine oil SAE 10 W oil Lithium base Grease with molybdenum disulphide to N.L.G.I. № 2

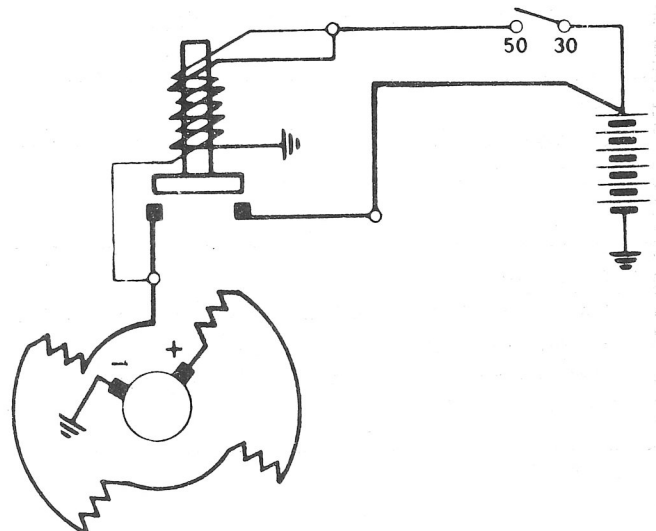
Typical curves of starter



Starter and solenoid assembly



Starter wiring diagram for operation test



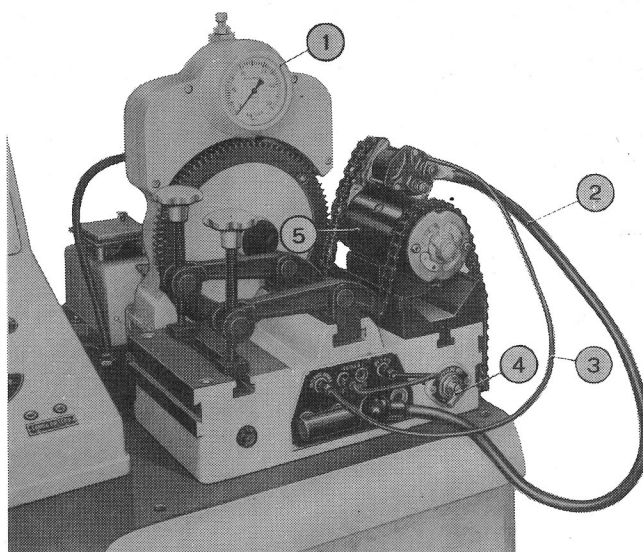
Stall torque test at 77°F(25°C) ambient temperature)

Adjust the voltage at starter terminals to obtain a current draw of 315 A, at 7 to 7,2 V. Lock the test benchring gear and move solenoid all the way in.

The starter should develop a torque of 5.9 ft. lb (8 Nm).

Starter under load and no-load operation test

1. Torque indicator
2. Current cable to starter
3. Current cable to solenoid
4. Starting switch
5. Starter



No-load test at 77°F(25°C) ambient temperature

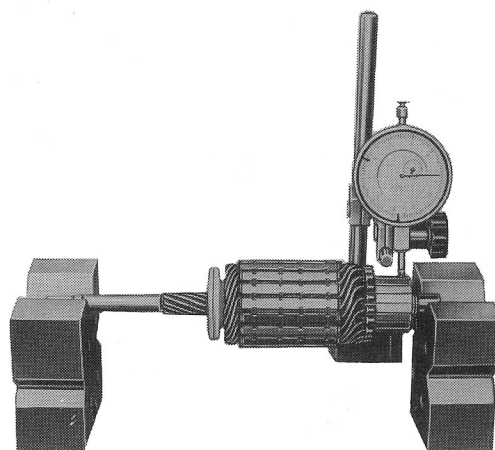
Working on the test bench, take the starter away from the ring gear to avoid that the pinion, at the end of its travel, may engage the ring gear.

The wiring is the same as for the preceding tests and the voltage at starter terminals will be adjusted to the specified 12 V value.

The current draw should not be in excess of 30 to 40 A with a voltage of 11,2 to 11,5 V, and the starter should be 6500 to 7500 r.p.m.

Checking commutator for runout, using dial indicator

Runout must not exceed .004 in. (0,01 mm).



Refacing Commutator

The armature assembly, removed from the starter, should be installed in a lathe, so that the commutator is turned down while causing the armature to rotate on its axis, thereby avoiding an out-of-round in excess of .004 in. (0,01 mm).

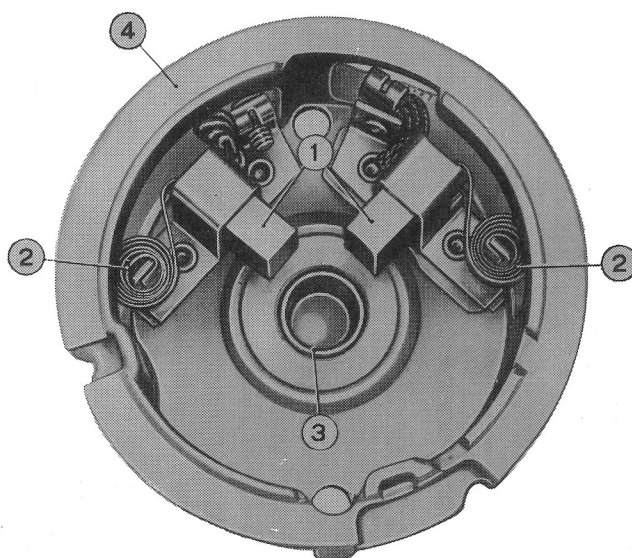
After the commutator has been turned down, undercut the mica between the segments.

Replacing Brushes

Remove dust cover, lift brush springs and replace worn brushes (1) with new ones.

Commutator end frame

1. Brushes
2. Brush springs
3. Bushing
4. Commutator end frame



DISASSEMBLY AND REASSEMBLY

Remove nut and washer from starter solenoid (5).

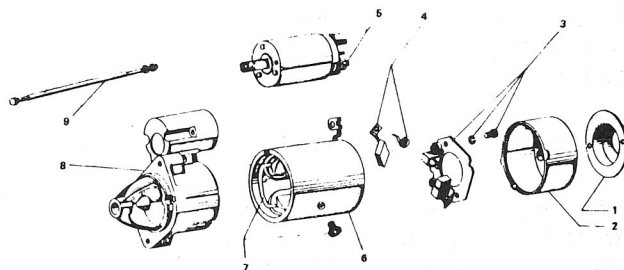
Disconnect terminal on housing assembly (7) from stud on starter solenoid (5).

Remove screws to remove starter solenoid (5).

Remove screws (9) and washers. Carefully separate cover (2) until brushes can be removed from brush holder.

Separate housing assembly (7) from support (8).

1. Cover
2. End plate
3. Brush holder
4. Brush
5. Solenoid
6. Housing
7. Field coils
8. Support
9. Screw



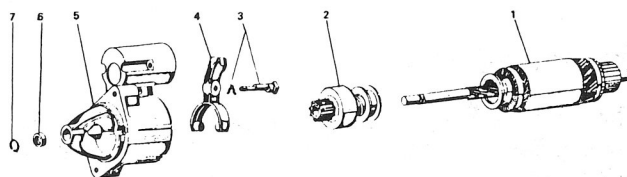
Remove pin (3).

Separate fork (4) and armature (1) with attached drive pinion from support (5).

Separate pinion (2), from armature (1).

Remove ring-lock washer (7) and bushing (6) only if damaged.

1. Armature
2. Pinion
3. Pin
4. Fork
5. Support
6. Bushing
7. Washer



Carefully slide field coils from housing. Assemble in reverse order of disassembly.

If a new coil is installed, preheat to about 120°F (49°C). This will aid fitting in housing.

Lubricate inner spline of pinion with 10 W oil.

SPECIFICATIONS

IGNITION SYSTEM YUGO 55/65

Firing order 1 - 3 - 4 - 2

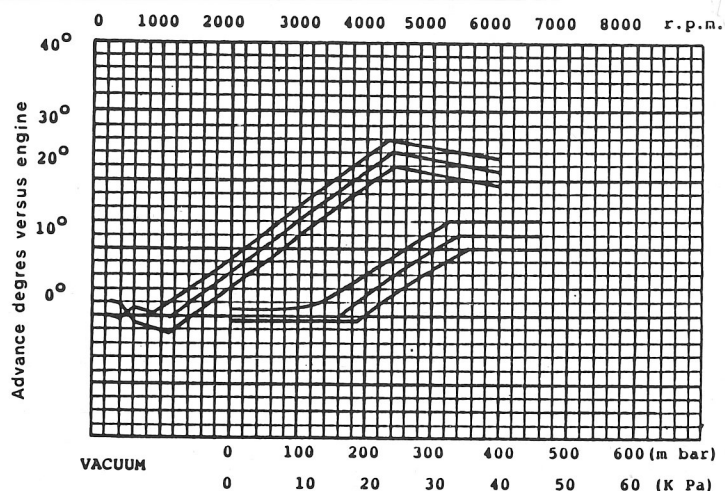
Distributor

Type	Bosch
Static advance (degrees BTDC 800 r.p.m.)	10°
Centrifugal advance	26° to 30°
Total advance (static and centrifugal)	36° to 40°
Vacuum advance with air pump	16° to 18°

Electronic Control Module

Type	Bosch
Current limiter output	4,5 to 6 amps
Input voltage	6 to 18 volts

Automatic advance diagram of ignition distributor installed on engine



Coil

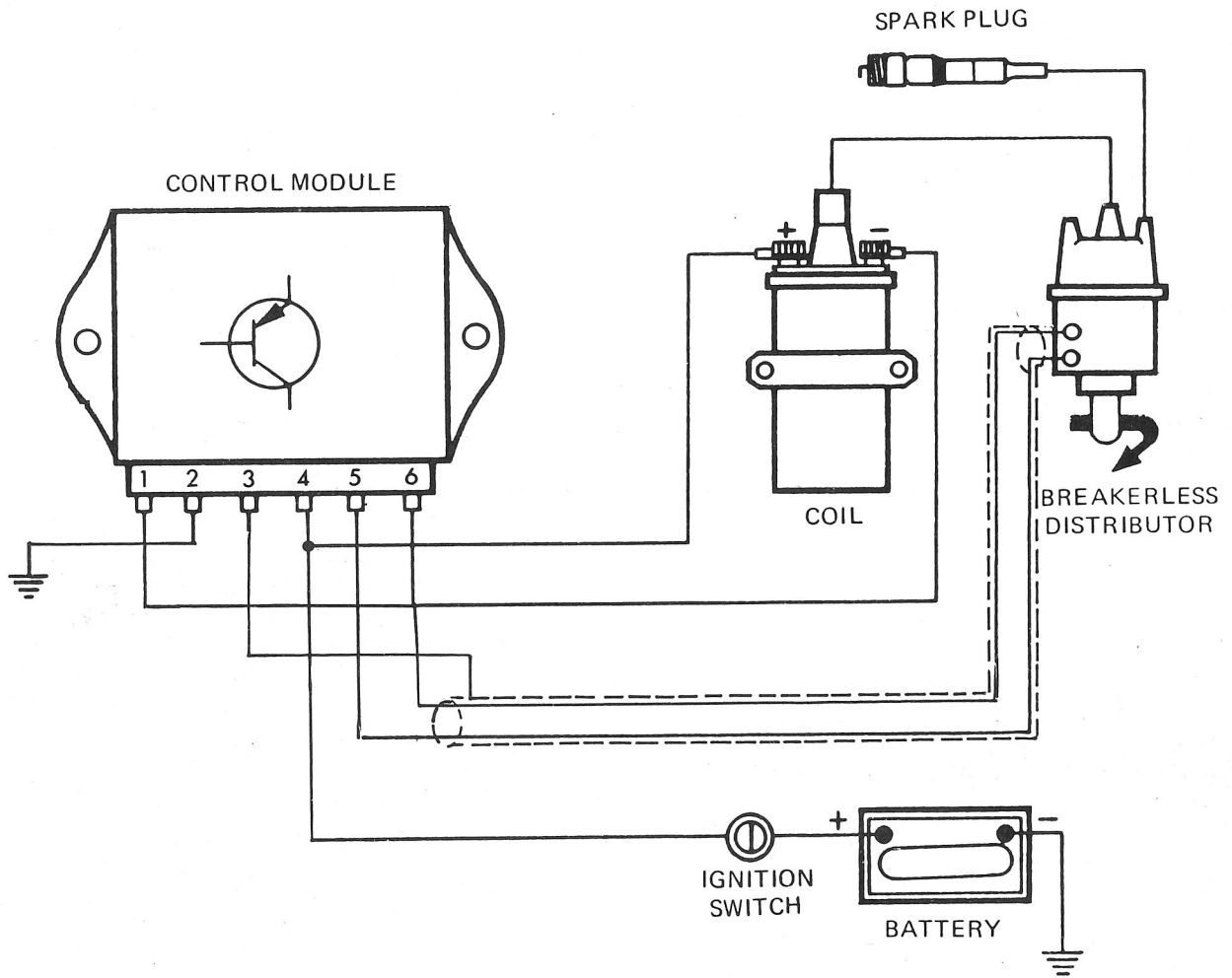
Type	Bosch
Primary winding resistance at 68°F (20°C)	0,7 ohms
Secondary winding resistance at 68°F (20°C)	9500 ohms
Ballast resistor resistance	

Spark Plugs

Thread diameter and pitch, metric	M 14 x 1.25.
Type	Energoinvest Bosch Champion Marelli
	Bosna FE 65 PR WR7D RN9Y CW7LPR
Gap028 to .032 in (0.7 to 0.8 mm)

DESCRIPTION

With ignition switch closed, battery voltage is supplied to electronic control module to primary side of ignition coil. Voltage is regulated by the control module to supply a regulated current to primary side of ignition coil. When the distributor turns, a trigger generates an impulse on the pickup assembly. This impulse is sensed by the control module, and turns the coil primary on and off. Each time the coil primary is turned off, a high voltage is induced in the coil secondary. The high voltage is distributed through the rotor and cap to the spark plugs.



SERVICE

Before performing any service observe the following.

DO NOT

- Energize ignition unless module support base is properly grounded.
- Crank engine with high voltage wire disconnected from coil.
- Disconnect high voltage wire from coil when engine is running.
- Ground primary circuit or use diagnostic equipment to ground primary circuit.
- Test for current or voltage by flashing terminals with each other or to ground.
- Disconnect battery cables when engine is running.

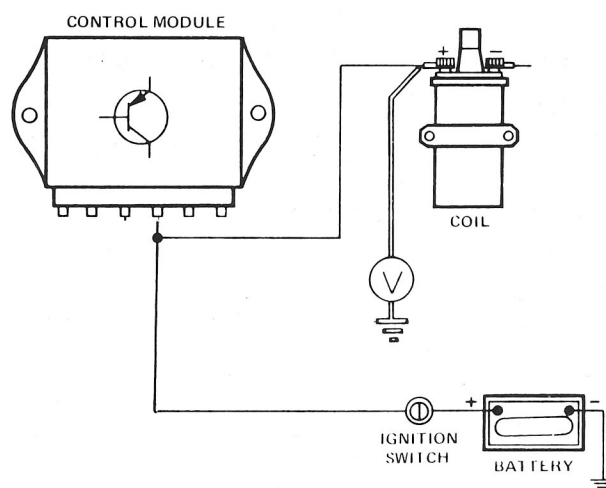
DO

- When required, the distributor pickup assembly may be disconnected when engine is running, or when cranking for compression testing.

PRIMARY INPUT CHECK

Connect voltmeter from coil B+ terminal to ground.

With ignition switch on, check for 12 volts (battery). If not, check for faulty battery, ignition switch, wiring, or connections.



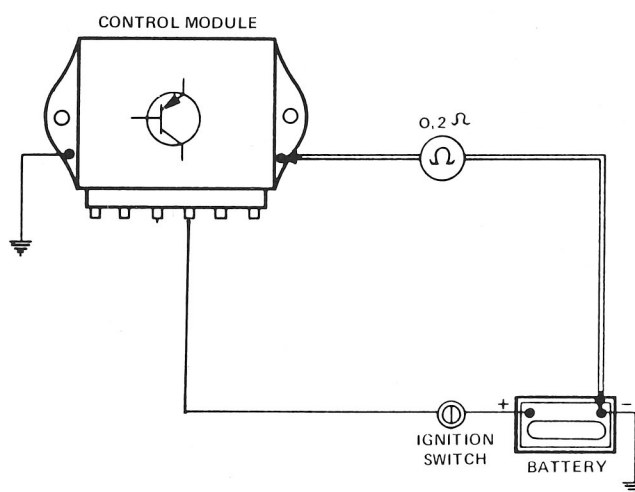
GROUND CHECK

With ignition switch off, connect an ohmmeter from control module support mount to battery ground terminal.

Check for less than 0.2 ohms.

If not, check support, mounting, and battery ground connections.

Also check that control module casing is clean, and that mounting hardware is clean and tight.



COIL RESISTANCE CHECK

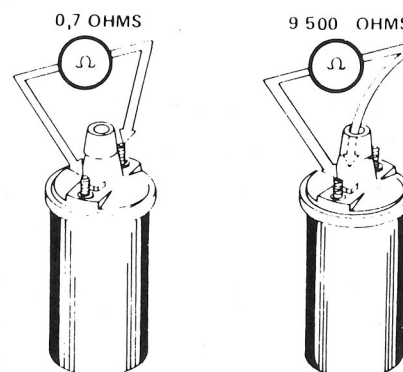
Disconnect primary leads from coil, then connect ohmmeter to coil.

Check for 0,7 ohms.

Reconnect one ohmmeter lead to coil high voltage terminal.

Check for 9500 ohms.

Replace coil if not within specifications.



PICKUP ASSEMBLY CHECK

Disconnect harness from control module.

Connect ohmmeter to pickup assembly connector

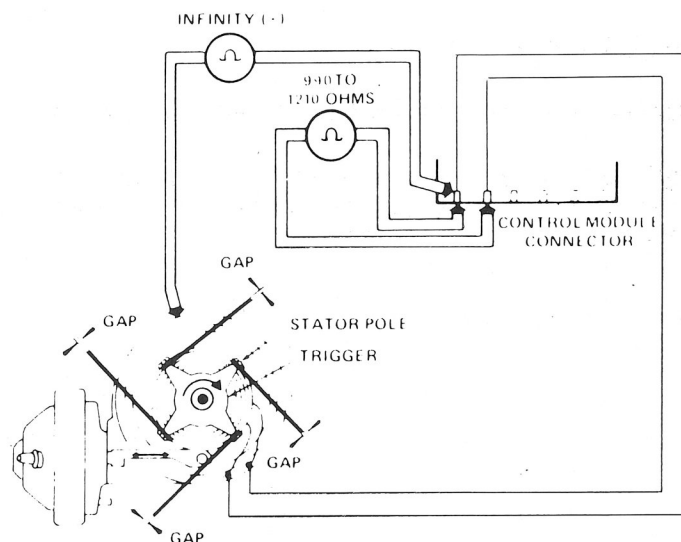
Check for 990 to 1210 ohms.

Reconnect one ohmmeter lead to distributor body.
Check for infinity ohms.

Replace pickup assembly if not within specifications.

Using a nonmagnetic feeler gauge check gap between stator pole and trigger. Adjust as required.

Gap should be .012 to .020 in (0.3 to 0.5 mm)



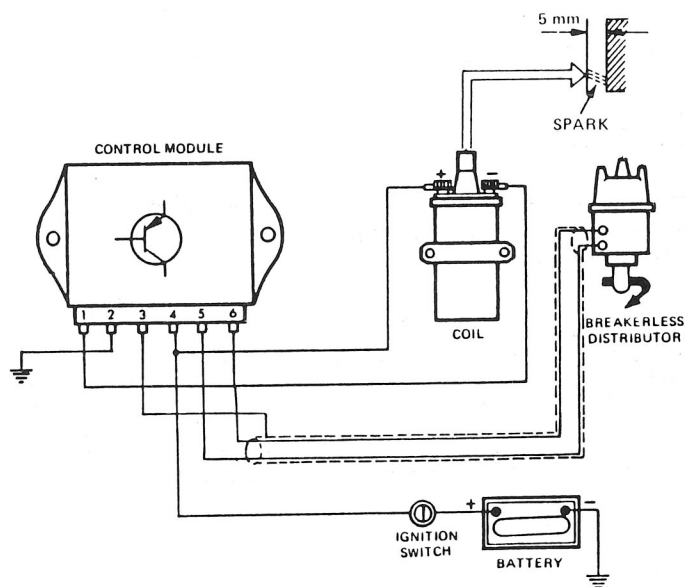
CONTROL MODULE CHECK

Reconnect primary leads to coil, pickup assembly to control module.

Disconnect high voltage wire from distributor. Do not disconnect from coil.

While holding (use insulated holder) high voltage wire about 5 mm from ground, crank engine and check for spark.

Replace control module if no spark appears.



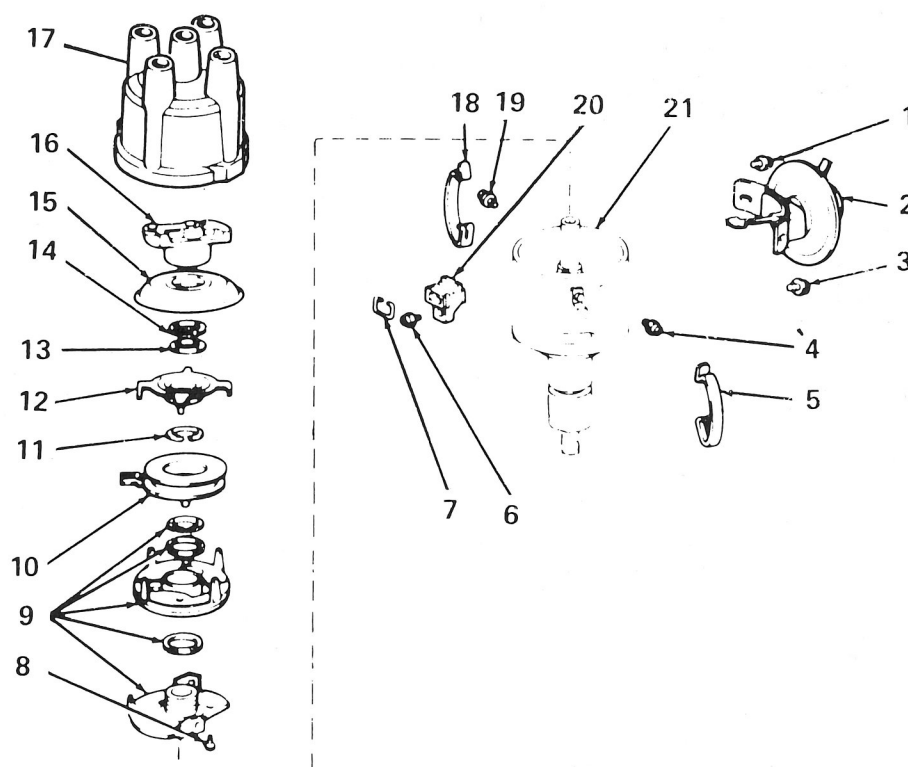
DISTRIBUTOR

Disassembly and reassembly

Unclip cap (17). Remove rotor (16) and cover (15). Remove screws (1 and 3) to remove vacuum diaphragm (2). Remove lock ring (14), lockwasher (13), trigger (12) and lock ring (11). Remove screw (6) to remove connector (20). Remove screws (4 and 19) to remove pickup coil (10) and pickup assembly (9). Remove screw (8) to separate pickup assembly. Remove clip (5 and 18) only if damaged.

Reassembly is reverse of disassembly.

1. Screw
2. Vacuum diaphragm
3. Screw
4. Screw
5. Spring clip
6. Screw
7. Spring clip
8. Screw
9. Pickup assembly
10. Pickup coil
11. Lock ring
12. Trigger
13. Lockwashers
14. Lock ring
15. Cover
16. Rotor
17. Cap
18. Spring clip
19. Screw
20. Connector
21. Housing



Inspection

Check distributor cap (17) for cracks, or corroded terminals. For light corrosion, clean terminals otherwise replace.

Check trigger (16) for cracks, breaks, or corrosion. Replace if damaged.

Check trigger (12) for bent or broken tabs. Replace if damaged.

Check pickup coil (10) for damaged wires. Check for 990 to 1210 ohms resistance. Replace if damaged or out of spec.

Check pickup assembly (9) for damaged parts. Replace if damaged.

Check vacuum diaphragm (2) for leakage. Replace if damaged.

Check housing (21) for worn or sticky shaft. Replace if damaged.

LIGHTING

Location	Standard
Headlights (high and low beams)	»Sealed Beam«
Front lamps:	
— Turn signal and parking	(12 V — 21/5 W)
Rear lamps:	
— Turn signal, back-up and stop	(12 V — 21 W)
— Tail	(12 V — 21 W)
— License plate	(12 V — 5 W)
Side marker lamps	(12 V — 3 W)
Hazard warning signal indicator	(12 V — 3 W)
Cigarette lighter light	(12 V — 3 W)

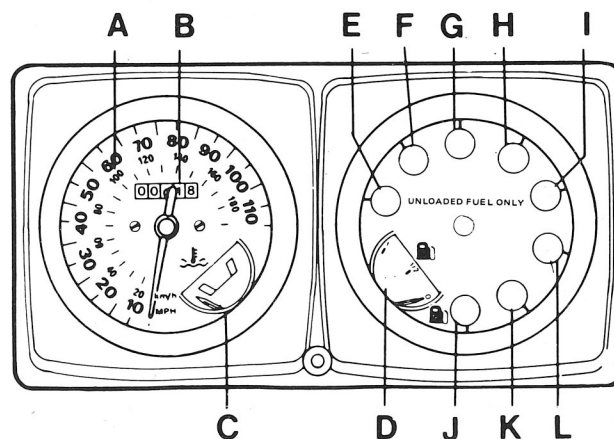
INSTRUMENT CLUSTER

Instruments:

- A. Speedometer
- B. Odometer
- C. Temperature gauge
- D. Fuel gauge

Indicators and warning lights:

- E. Seat belt warning light
- F. Battery charge indicator
- G. Hand brake and low brake fluid
- H. Oil pressure warning light
- I. High beam headlight indicator
- J. Fuel reserve warning light
- K. Turn signal indicator
- L. Parking and low beam headlights indicator

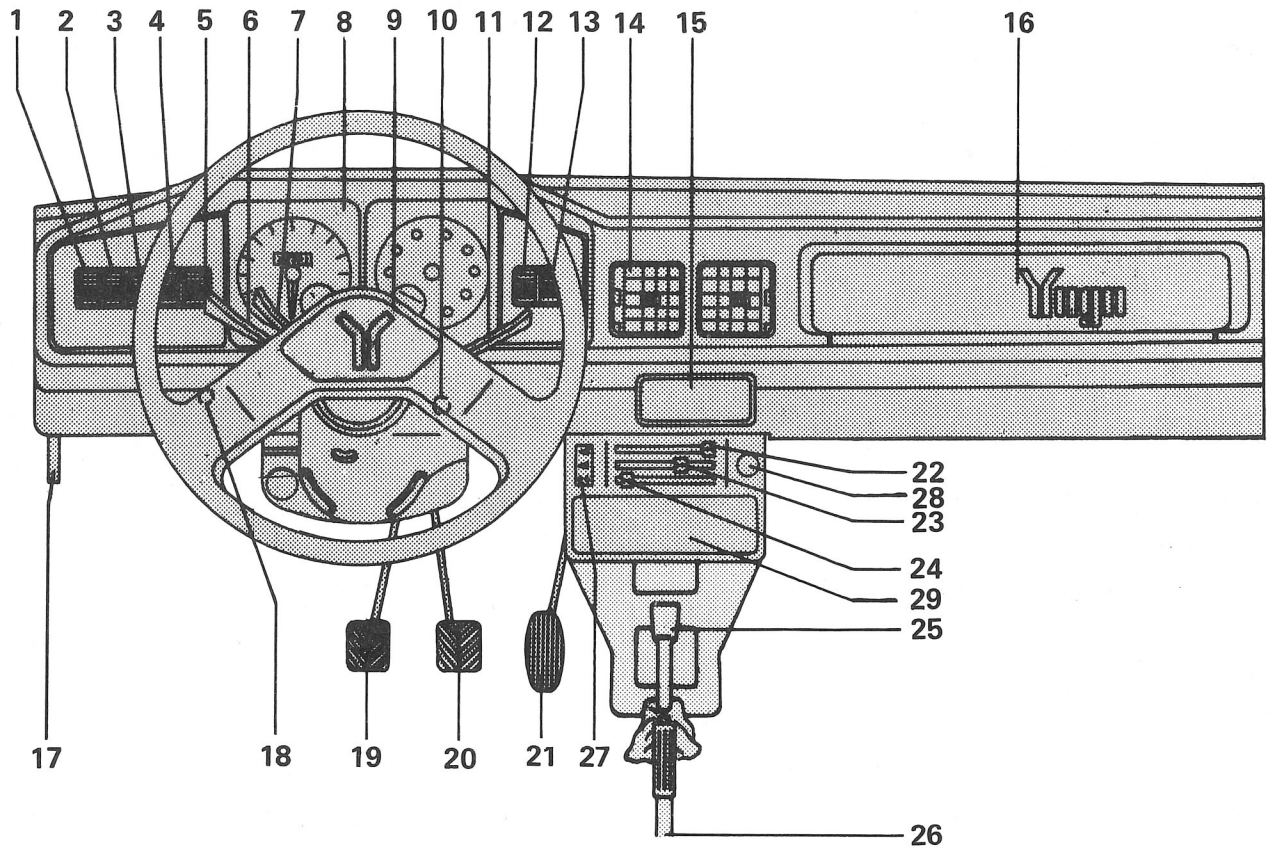


INSTRUMENTS, CONTROLS AND INDICATORS

WARNING LIGHTS

— low oil pressure warning light	red
— oil pressure (light turns on) psi/bar	2,8 to 8,5/0,2 to 0,6
Charge warning light	red
Low fuel warning light	amber
— fuel reserve supply gal/dm ³	.71 to 1.32/3 to 5
High beam indicator	blue
Parking light indicator	green
Hand brake indicator	red
Seat belt indicator	red
Turn signals and indicator	
Number of cycles per minute of flasher, under a nominal total load of 46 W:	
— at 12 V and 68°F (20°C)	85 ± 8
— at a voltage 1,25 times the nominal one (15 V) and at 104°F (40°C)	≤ 120
— at a voltage 0,9 times the nominal one (10,8 V) and at 68°F (20°C)	≥ 60

INSTRUMENTS AND CONTROLS



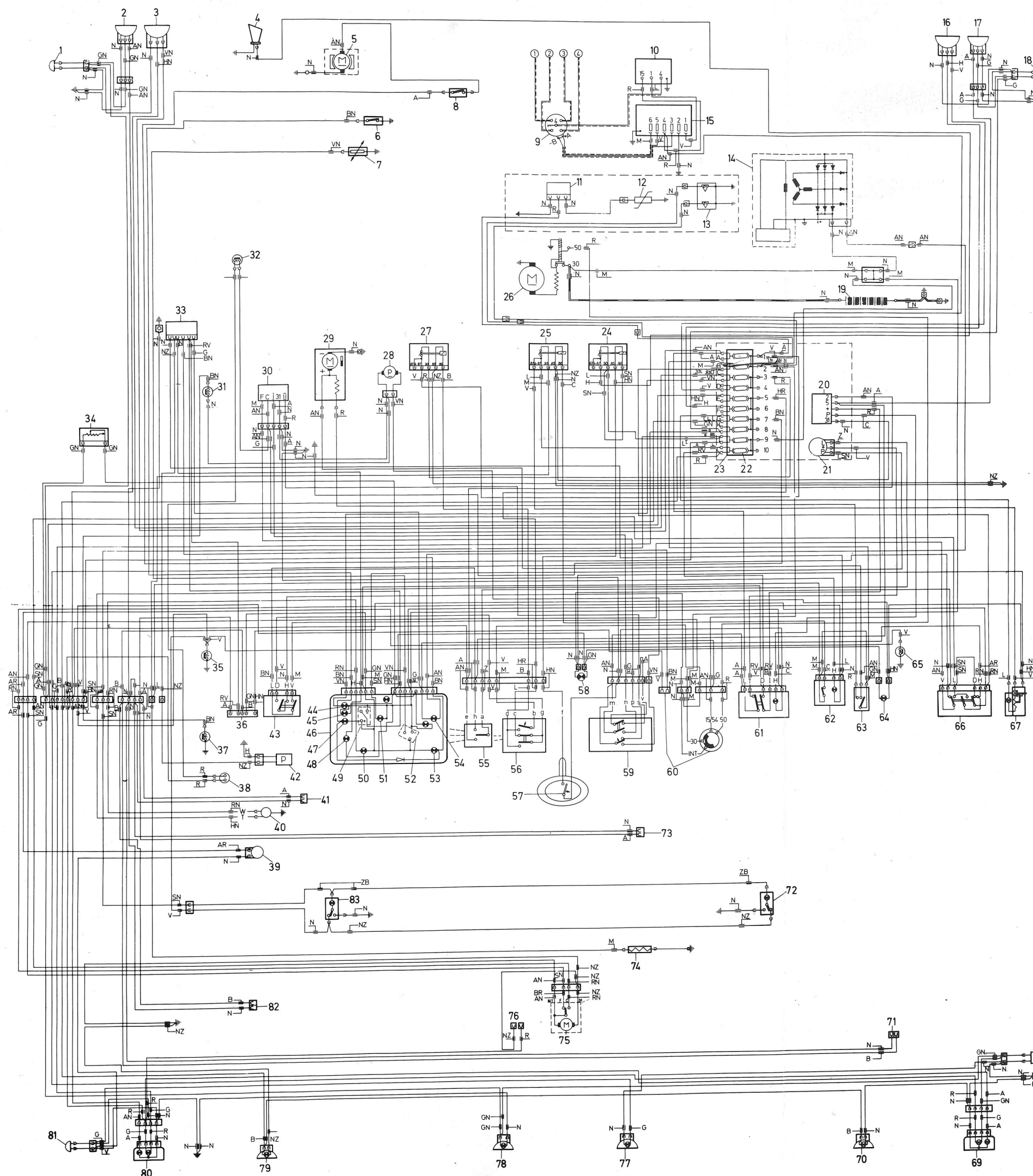
Instruments, controls and indicators

- | | |
|------------------------------------|--|
| 1. Light switch | 16. Shelf |
| 2. Heater/defroster fan switch | 17. Hood release handle |
| 3. Hazard warning switch | 18. Instrument lights rheostat |
| 4. Rear window wiper/washer switch | 19. Clutch pedal |
| 5. Rear window defogger switch | 20. Brake pedal |
| 6. Hi-beam switch | 21. Accelerator pedal |
| 7. Turn signal switch | 22. Heater temperature control lever |
| 8. Instrument cluster | 23. Air flow control lever |
| 9. Horn button | 24. Floor/defrost lever |
| 10. Ignition switch | 25. Shift lever |
| 11. Windshield wiper/washer switch | 26. Hand brake lever |
| 12. Spare switch | 27. Heater control panel (illuminated) |
| 13. Spare switch | 28. Lighter |
| 14. Air outlets | 29. Radio receptacle |
| 15. Ashtray | |

CIRCUIT PROTECTION FUSES

FUSES	PROTECTED CURRENT CIRCUITS
	The system is protected by eight 8-Amp. fuses and two 16-Amp. fuses.
1 (A) (8 Amps)	Turn lights and turn indicator Hazard warning light Back-up light Wiper motor Windshield washer pump Carburetor solenoid valves
2 (B) (8 Amps)	Fuel level gauge and indicator Coolant temperature gauge and indicator Rear wiper Rear wiper switch Rear window defogger switch Heater fan motor Radio Electric choke
3 (C) (8 Amps)	Left headlight beam, high beam indicator Instrument cluster lights
4 (D) (8 Amps)	Right headlight high beam
5 (E) (8 Amps)	Left headlight low beam
6 (F) (8 Amps)	Right headlight low beam
7 (G) (8 Amps)	Left front park light Left front marker light Right rear park light Right rear marker light Left license light Rheostat (instrument lights)
8 (H) (8 Amps)	Right front park light Right front marker light Left rear park light Left rear marker light Right license light
9 (I) (16 Amps)	Cooling fan Horns Horn relay Interior lights
10 (L) (16 Amps)	Stop light switch Hazard warning light switch Ignition key warning Rear window defogger Relay
Unprotected circuits	Alternator circuits, and charge warning light Ignition and starting

WIRING DIAGRAM



1. Side turn and parking light, L. H.
2. Front turn signal, L. H.
3. Halogen headlamp, L. H.
4. Horn
5. Cooling fan motor
6. Oil pressure sending unit
7. Coolant temperature sending unit and thermostat
8. Radiator cooling motor sending unit
9. Distributor with inductive sending unit
10. Ignition coil
11. Vacuum switch
12. Carburettor choke
13. Carburettor electric valves
14. Alternator
15. Electronic module
16. Halogen headlamp, R. H.
17. Front turn signal, R. H.
18. Side turn and parking light, R. H.
19. Battery
20. Hazard warning light
21. Flasher
22. Fuses
23. Fuse box
24. Horn relay
25. Defroster relay
26. Starter motor
27. Halogen headlamps relay (high beam)
28. Windshield washer electric pump
29. Two — speed heater motor
30. Two — speed wiper motor
31. Brake failure switch
32. Backup light switch
33. Buzzer
34. Rheostat
35. Interior light switch, L. H.
36. Radio — cassette player connection
37. Brake failure warning light switch
38. Brake light switch
39. Rear screen washer electric pump
40. Fuel level sending unit
41. Door speaker, L. H.
42. Seat belt micro switch

43. Three position light rocker switch
44. High beam warning light
45. Parking and instrument cluster warning light
46. Instrument cluster
47. Insufficient oil pressure warning light
48. Seat belt warning light
49. Fuel level gauge
50. Fuel reserve warning light
51. Turn signal warning light
52. Temperature indicator
53. Brake failure warning light
54. Generator charge warning light
55. Steering column turn switch
56. Steering column low and high beam switch
57. Horn button
58. Light cables
59. Steering column wipe and wash switch
60. Ignition lock
61. Hazard warning light switch
62. Defroster warning light switch
63. Heater switch
64. Heater ideogram light
65. Interior light switch, R. H.
66. Rear wipe and wash switch
67. Electric cigarette lighter
68. Rear turn and parking light
69. Rear parking, turn and brake light
70. Backup light, R. H.
71. Rear speaker, R. H.
72. Dome light and switch, R. H.
73. Door speaker, R. H.
74. Defroster
75. Rear wiper electric motor
76. Additional rear stop light
77. Licence plate light, R. H.
78. Licence plate light, L. H.
79. Backup light, L. H.
80. Rear parking, turn and brake light
81. Rear side turn and parking light
82. Rear speaker, L. H.
83. Dome light and switch, L. H.

CABLE COLORS

- A — Light blue
B — White
C — Orange
G — Yellow
H — Grey
L — Dark blue
M — Brown
N — Black
R — Red
V — Green
Z — Violet
RV — Red — green

- AR — Blue — red
AN — Blue — black
BN — White — black
BR — White — red
GN — Yellow — black
HN — Grey — black
HR — Grey — red
NZ — Black — violet
RN — Red — black
SN — Pink — black
VN — Green — black
ZB — Violet — white

ACCESSORIES

ACCESSORIES

	Page
SPECIFICATIONS	8-1
VENTILATION AND HEATING	8-2
WINDSHIELD WIPER/WASHER	8-5
REAR WINDOW WIPER/WASHER	8-7

SPECIFICATIONS

Windshield Wiper (Two speed motor) Wiper strokes per minute Wiper motor bench test: Feed voltage Stall torque Stator temperature rise Speed (warmed up) Current draw (warmed up) Static torque (shaft blocked), warmed up and at 14 V Wiper blade pressure on windshield	crank and linkage type 45 and 60 14 V INm 104 to 122°F (40 to 50°C) 60 to 70 r.p.m. ≤ 2 A 1180 Nm 5,4 N
Heater Ventilation Fan (With two speeds) Nominal speed with fan, at 12 V and 77° F. (25°C): — speed, resistor »in« ($1 \pm 0,1$ ohm)	 2050 ± 150 r.p.m. 3100 ± 150 r.p.m.
Nominal output Motor direction of rotation (fan side)	18 W counterclockwise

VENTILATION AND HEATING

VENTILATION

If lever (2) is moved right a supply of cool air is obtained through outlets.

The amount of outside air entering the passenger compartment depends on the car speed. When the car is moving slowly, the air flow can be boosted by starting the two-speed fan with switch (17).

MID-SEASON OPERATION

Steaming of the windshield in this period can be avoided by directing fresh air against the windshield.

If it is desired that the air flowing in be slightly warmed up, slide right which regulates the amount of hot water delivered to the heater core.

1. Heater temperature control lever
2. Air flow control lever
3. Vent/defrost lever
4. Heater control lighting

REMOVAL AND INSTALLATION

To remove the heater assembly, it will first be necessary to drain the coolant both from the engine radiator and the heater radiator. To drain the latter, move lever (1), controlling the water valve, all the way to the right.

Then proceed as follows:

- Loosen clips retaining hoses for heater water inflow and return.
- Remove the attaching screw and nut from air admission shutter actuating rod
- Remove the air conveyor, after screw and plain washer have been taken out from inside, and slide out radiator housing spring clips (11).
- Withdraw outside air admission shutter actuating rod.
- Remove heater valve control cable.
- Remove heater core (9).
- Back out fan housing attaching nuts from body.

HEATING

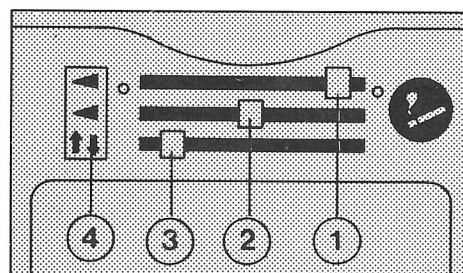
To activate the heating system operate lever (1). Now the temperature in passenger compartment can be regulated by suitably moving lever (3) until the desired temperature is reached.

To avoid the fogging of glass panes and prevent the frost and ice from building up, turn lever (1), all the way right, close shutter to direct the air flow against the windshield.

Turn on the fan, if required

If the car is to be left unused for some time in winter weather and the engine cooling system has not been filled with anti-freeze, the water remaining in the heater after the engine has been drained must be released by moving lever (1) to the right.

NOTE — If heating is insufficient, the thermostat located in duct from engine to radiator should be checked for proper operation.

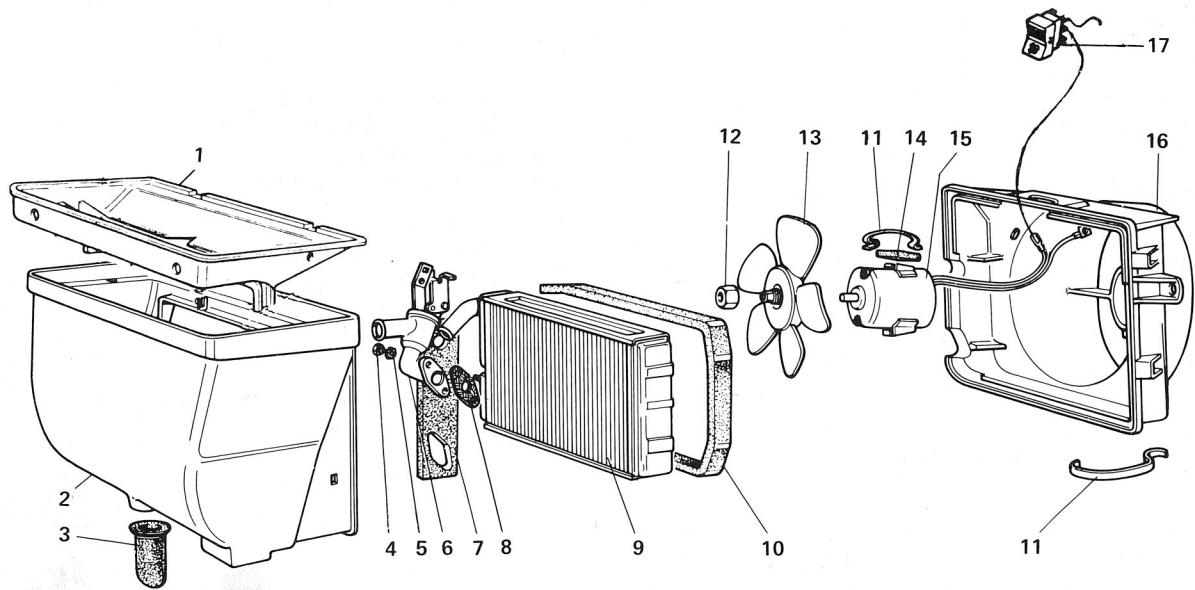


- Disconnect yellow and blue-black wires feeding the fan motor at the fan switch.

NOTE — The fan ground cable is located on the L.H. side of the radiator and is released by unscrewing one of the nuts attaching the fan assembly to the body.

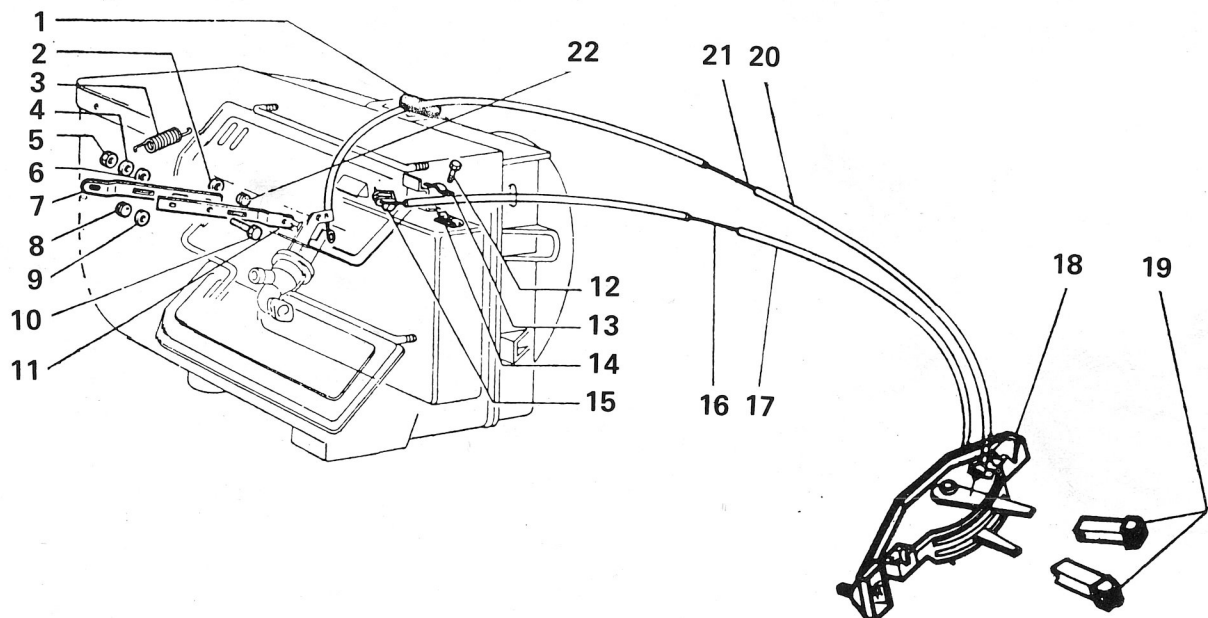
To refit the assembly to the car, reverse the above operations, but take care to insert the gasket between the fan housing and the body correctly, and to reconnect the water hoses to the engine, so that these connections are water tight. Do not forget to reconnect the fan ground lead.

After refitting the heater to the car, the engine and heater radiators must be refilled with water. To ensure that the heater radiator is properly filled, the engine should be run for a few minutes with lever (1) all the way right, and the engine radiator topped up again.



Heater assembly components

- | | | |
|---------------------|--------------------------------------|-----------------|
| 1. Water shield | 7. Gasket | 13. Impeller |
| 2. Housing | 8. Gasket | 14. Rubber pad |
| 3. Water drain plug | 9. Radiator | 15. Motor |
| 4. Nut | 10. Gasket | 16. Fan housing |
| 5. Spring washer | 11. Spring clips | 17. Switch |
| 6. Valve | 12. Nut, attaching impeller to motor | |



Heating and circulation controls

- | | | | |
|-------------------|----------------|-----------------|------------------------|
| 1. Rubber ring | 6. Flat washer | 11. Pin | 17. Cover cable lining |
| 2. Elastic bumper | 7. Pin | 12. Bolt | 18. Handle |
| 3. Spring | 8. Spring | 13. Circlip | 19. Support |
| 4. Spring washer | 9. Flat washer | 14. Plate | 20. Tap cable lining |
| 5. Nut | 10. Bolt | 15. Bracket | 21. Tap cable |
| | | 16. Cover cable | 22. Spring |

DISASSEMBLY AND REASSEMBLY

The heater assembly can be taken apart in the following components: fan, valve, radiator, housings and air inlet and outlet shutters.

To disassemble a heater proceed as follows:

To remove the motor, just take out the two spring clips securing it to the housing and slide it out.

Unscrew the nut which holds the impeller to the motor through the self-centering hub.

To remove the valve, out the two nuts and washers securing it to the heater core.

When reinstalling the valve, make sure the rubber seal is correctly positioned, to avoid that it may protrude from the flange and cause water leakages

AIR INLET AND DISTRIBUTION SHUTTERS

To remove the sheet metal air inlet shutters, unscrew the two nuts with washers attaching the hinge to the radiator housing.

INSPECTIONS AND REPAIRS

Inspect the core for signs of dents, cracks or breaks. In these cases, if the appropriate equipment is available, repair as required. Otherwise, replace the unit.

It may occur that the valve fails to maintain a watertight seal, as a result of corrosion or aging. In case of faulty operation, replace the valve.

If the electrofan is inoperative, it will be necessary to find out first whether the trouble is traceable to the motor or to defective circuit wiring.

Check the following:

- Wiring and connections between the electrofan motor and its control switch on the instrument panel.

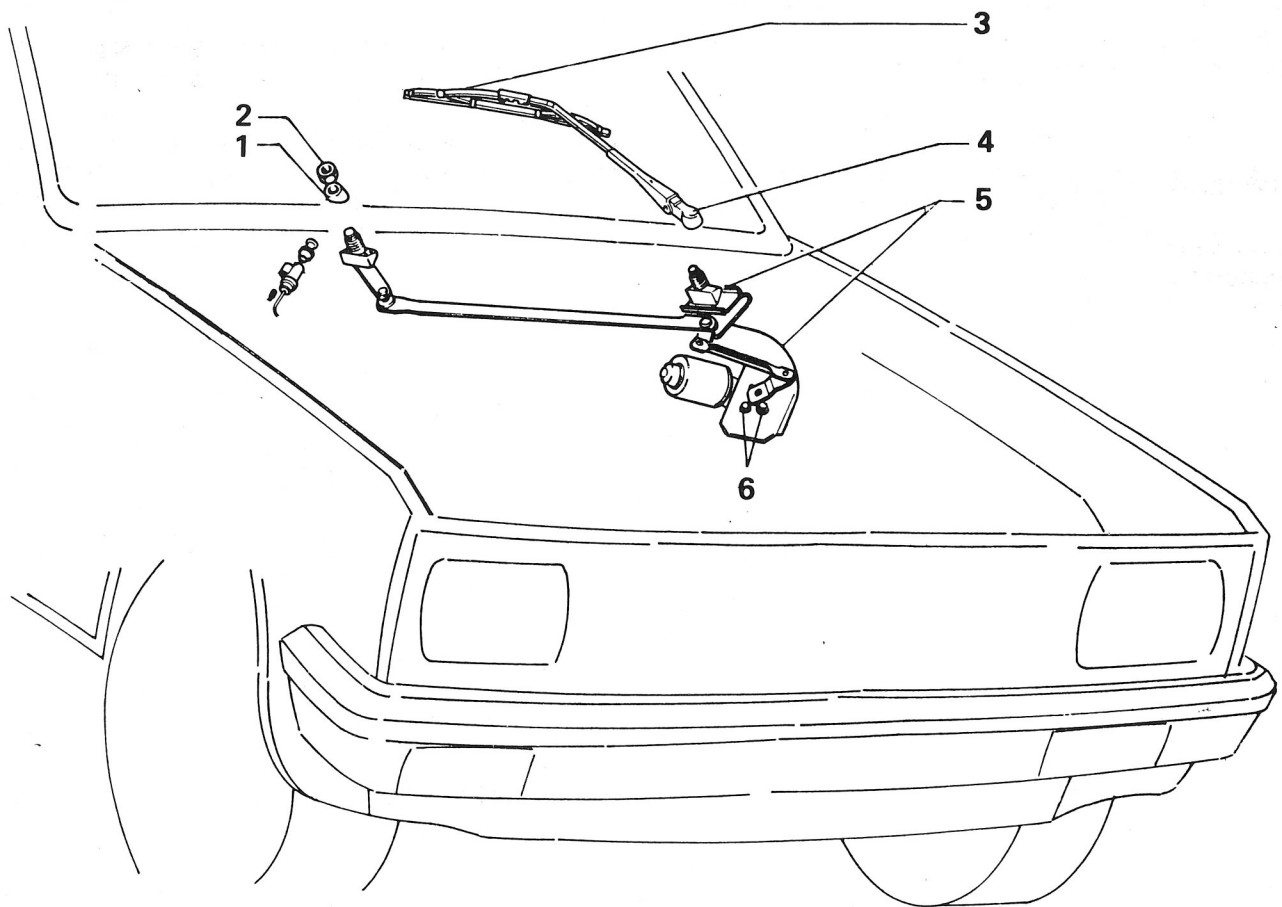
- Wiring between the control switch and the fuse block and motor ground lead.

- fuse blown

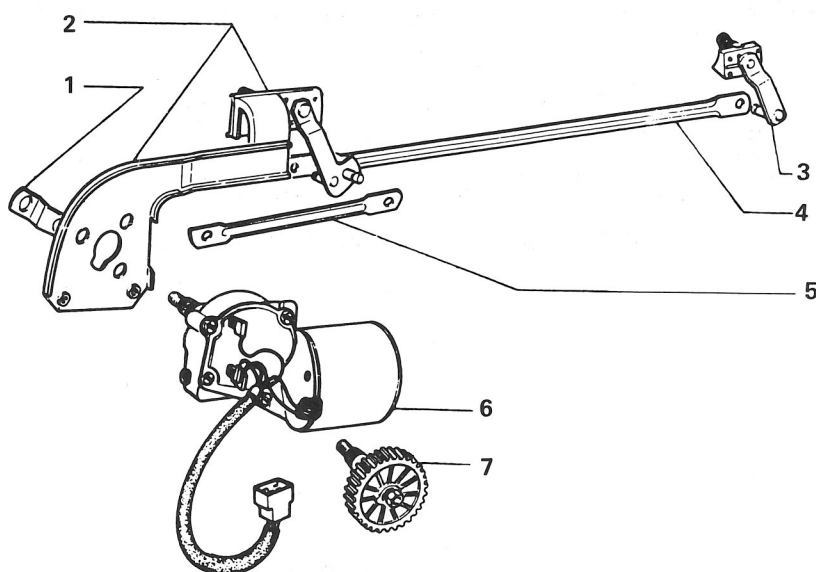
If the motor is at fault, replace it with a new one. In any case prior to reinstalling the electrofan motor, run it on the test bench and check operation to specifications shown in the table.

WINDSHIELD WIPER**Removal of windshield wiper motor and linkage mechanism**

- Remove the wiper blade arm (4)
- Undo the nuts (2)
- Open the hood
- Undo the two bolts (6) fixing the wiper mechanism to car body
- Remove the windshield wiper mechanism (5)

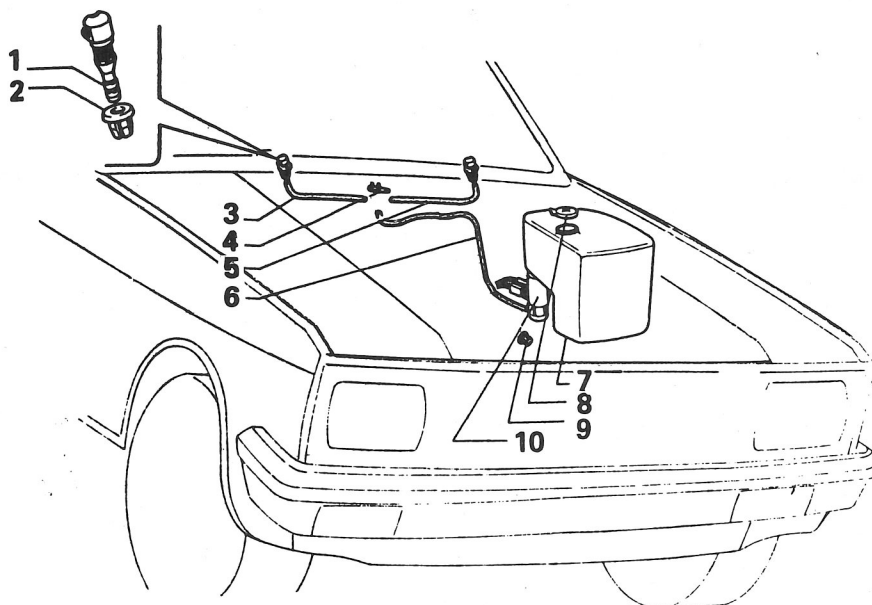


1. Spacer
2. Nut
3. Wiper blade
4. Wiper blade arm
5. Wiper mechanism
6. Bolts



WINDSHIELD WIPER

- | | |
|--------------------------|-----------------------------|
| 1. Link - motor | 4. Link - wiper |
| 2. Support - wiper motor | 5. Link - wiper |
| 3. Link — wiper | 6. Motor - windshield wiper |
| | 7. Gear - wiper motor |



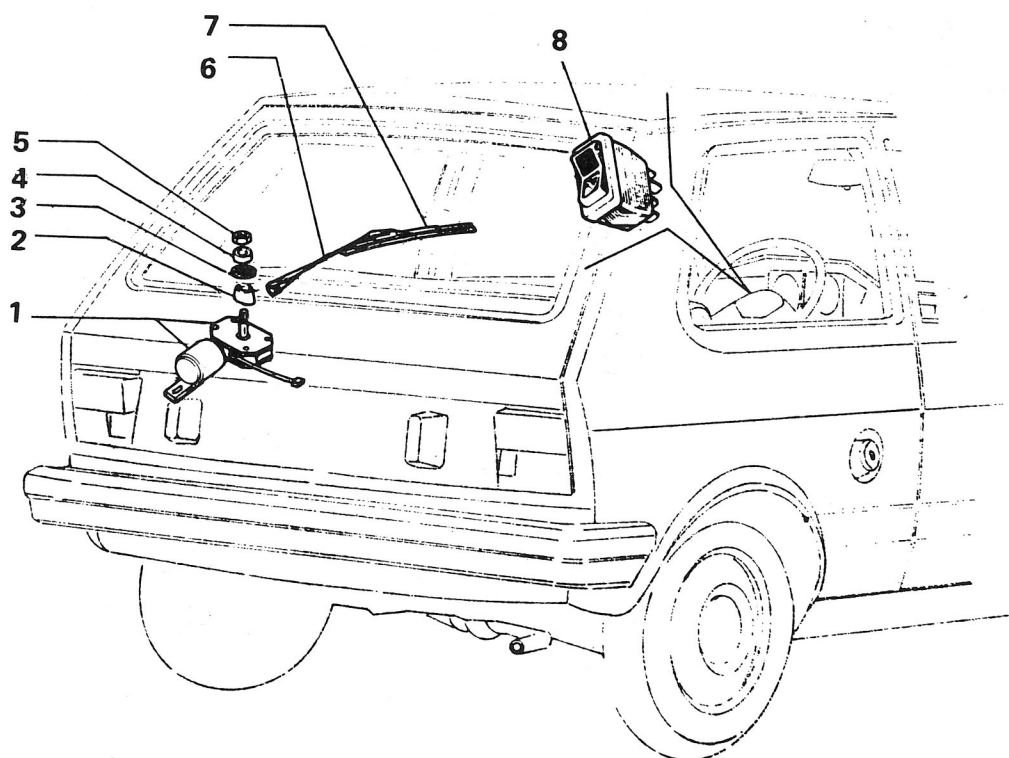
WINDSHIELD WASHER

- | | |
|---------------------------------|-----------------------------|
| 1. Jet - windshield/washer | 6. Hose - windshield washer |
| 2. Clip - windshield washer jet | 7. Reservoir |
| 3. Hose - windshield washer | 8. Cap |
| 4. Fitting | 9. Cap |
| 5. Hose - windshield washer | 10. Pump |

REAR WINDOW WIPER/WASHER

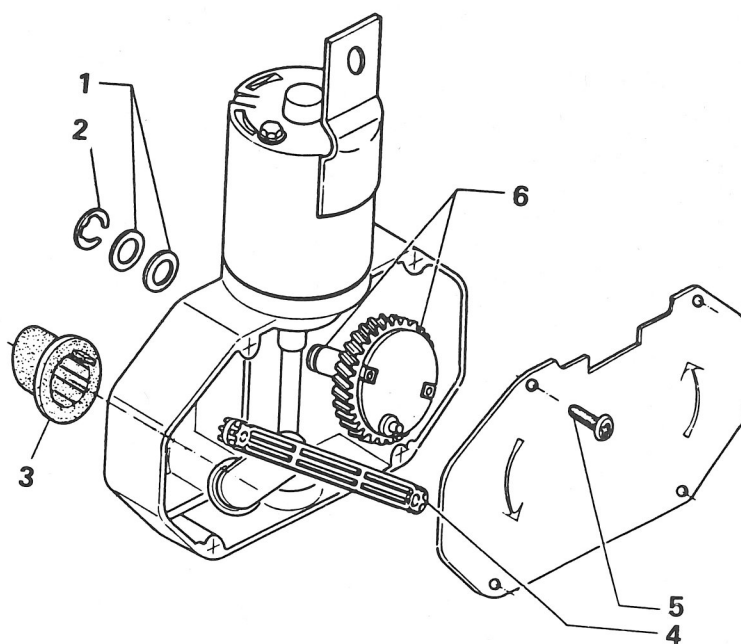
Removal of the rear wiper motor and linkage mechanism

- Remove the wiper blade arm (6)
- Undo the nut (5) and remove the parts (3) and (4)
- Open the hatch
- Undo four bolts and remove protective plastic cap
- Undo the bolt fixing the wiper motor to door frame.



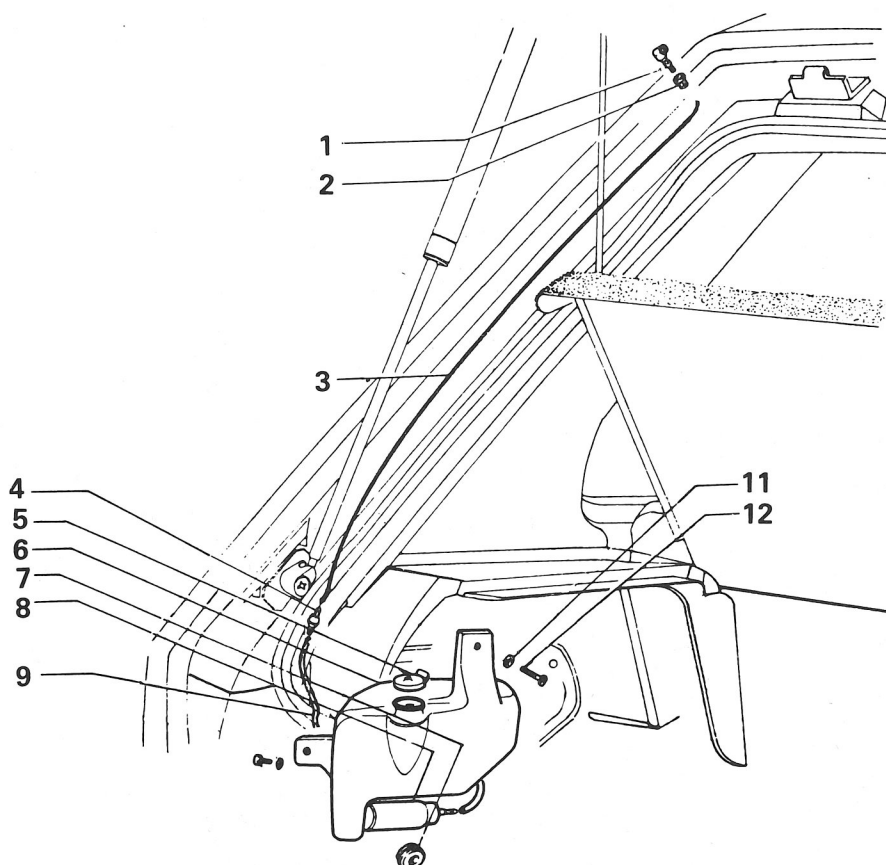
- 1. Wiper motor assembly
- 2. Spacer
- 3. Washer
- 4. Spacer

- 5. Nut
- 6. Wiper blade arm
- 7. Wiper blade
- 8. Rear wiper switch



REAR WIPER MOTOR

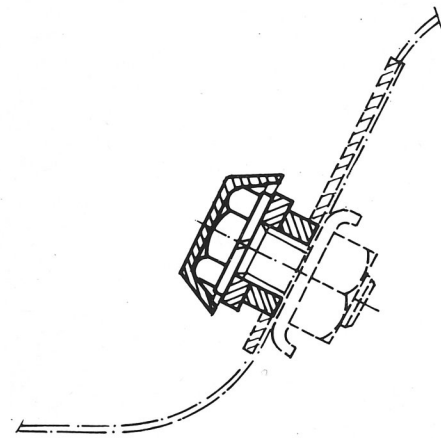
1. Washer
2. Clip - wiper motor
3. Seal - wiper motor
4. Tie rod - wiper motor
5. Bolt
6. Gear



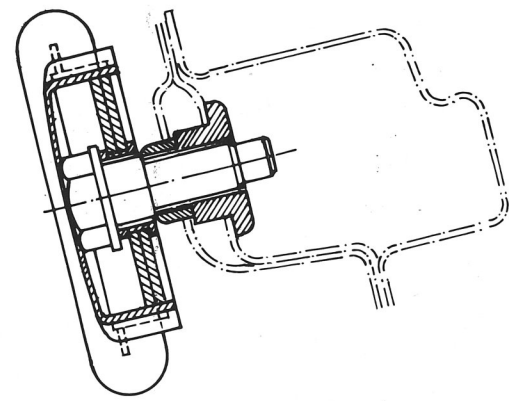
REAR WASHER

1. Jet - windshield washer
2. Clip
3. Tube
4. Connector w/washer line
5. Cap - w/washer reservoir
6. Reservoir
7. Plug
8. Pump - washer
9. Tube - w/washer
10. Screw - w/washer tank
11. Washer
12. Tie rod - washer

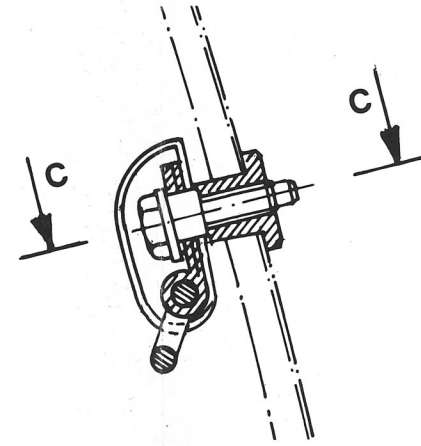
SECTION H - H



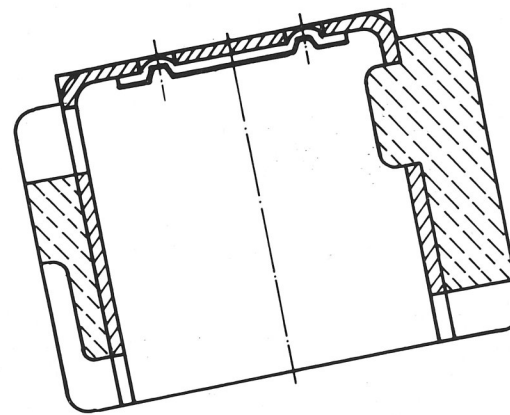
SECTION C - C



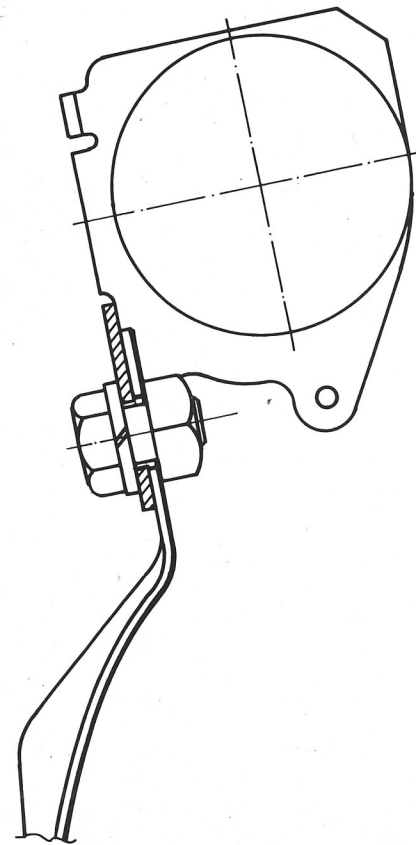
SECTION B - B



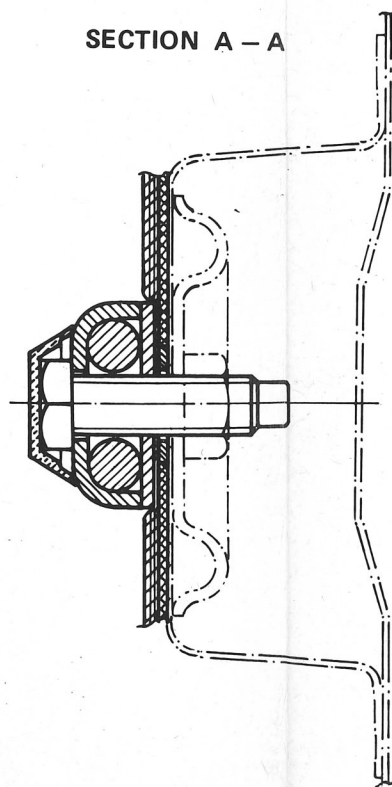
SECTION E - E



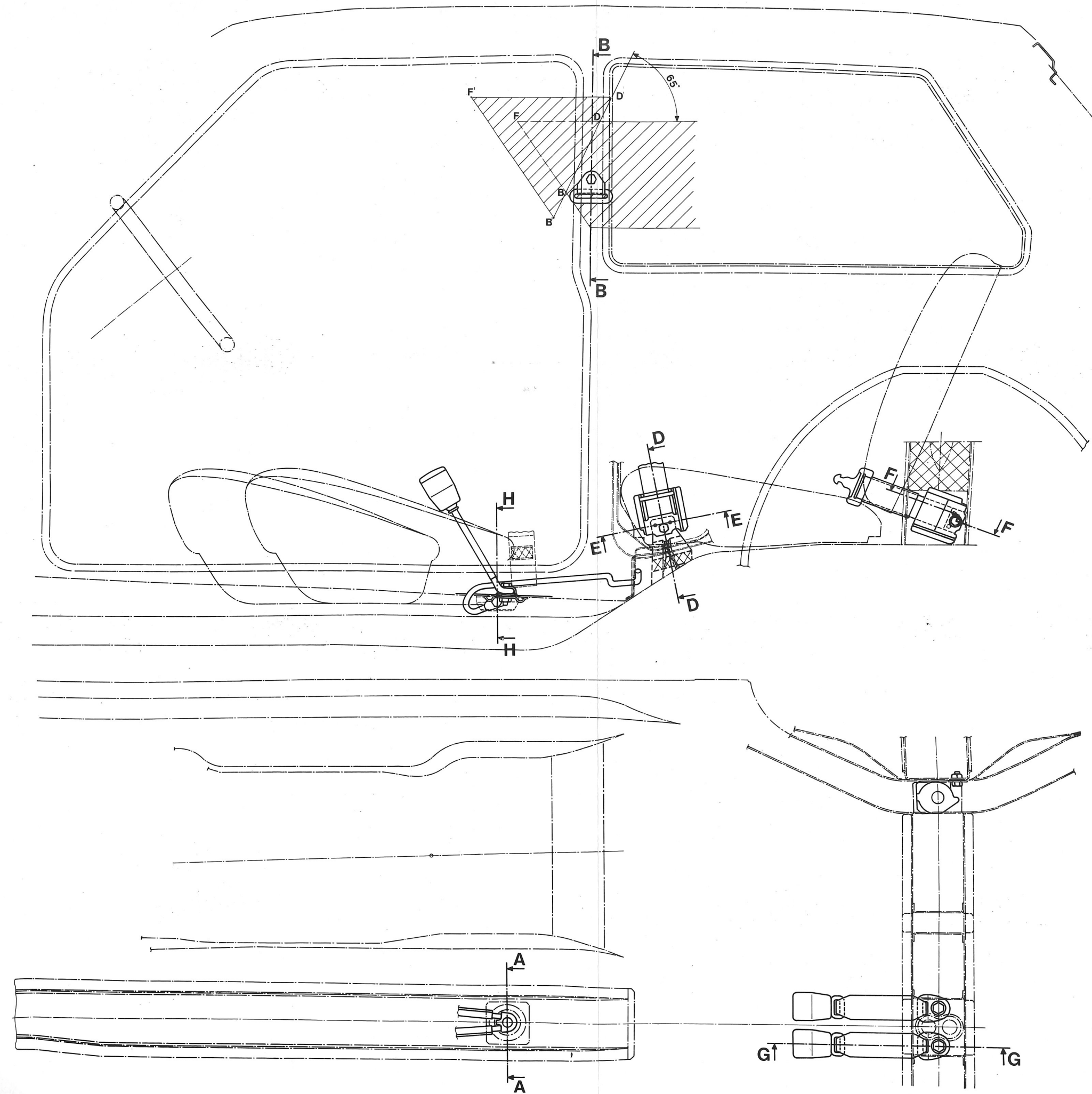
SECTION D - D



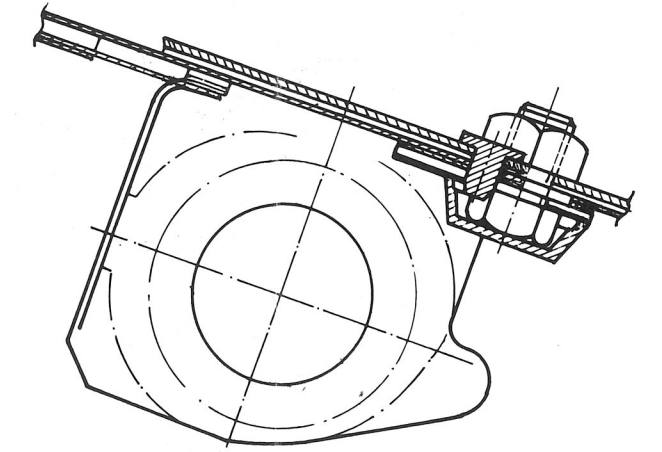
SECTION A - A



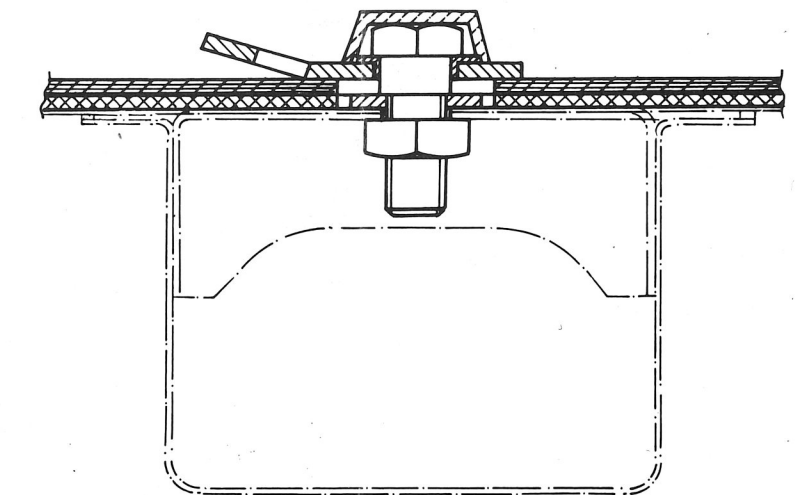
SEAT BELTS INSTALLING



SECTION F - F



SECTION G - G



PROCEDURE:

- Open the doors and rear hatch.
- Tilt the front seats forward.
- Remove the bolts from the support bars of the seat.
- Remove the seat assembly from the vehicle.
- Remove trim panel.
- Remove the screws from the rear seat bottom frame.
- Remove the rear headrests and the rear package shelf.
- Fold the rear seatback down and tilt the assembly forward.
- Locate the seat belt anchorages as shown.

NOTE: Connecting bolts must be tightened by torque of 34 Nm.

BODY

BODY

	Page
GENERAL INFORMATION	9-1
BODY ELEMENTS	9-2
HOOD	9-3
INSTRUMENT PANEL	9-4
DOORS	9-4
REAR QUARTER WINDOW	9-7

GENERAL INFORMATION

The car body is a three door type.

Side doors are fitted with hinges at front end and open in the opposite direction to air resistance when the car is in motion.

Windows are made of safety glass. Quarter lights are pivoted. The drop glass slides vertically in guides provided in the control mechanism handle.

The door can be locked from the outside by means of a key and locked from the inside by means of an inside locking knob.

The hatch is with hinges at the top and tendency to close by its own weight. An air operated shock absorber is provided at the left hand side to absorb undesirable oscillations.

The locks are of cassette type with an oscillating handle. For esthetic and safety reasons the locks are recessed into the door panel.

The hood is with hinges at front and is lift opened in the opposite direction to air resistance when the car is in motion.

The hood safety lock is released by means of a control handle inside the engine compartment.

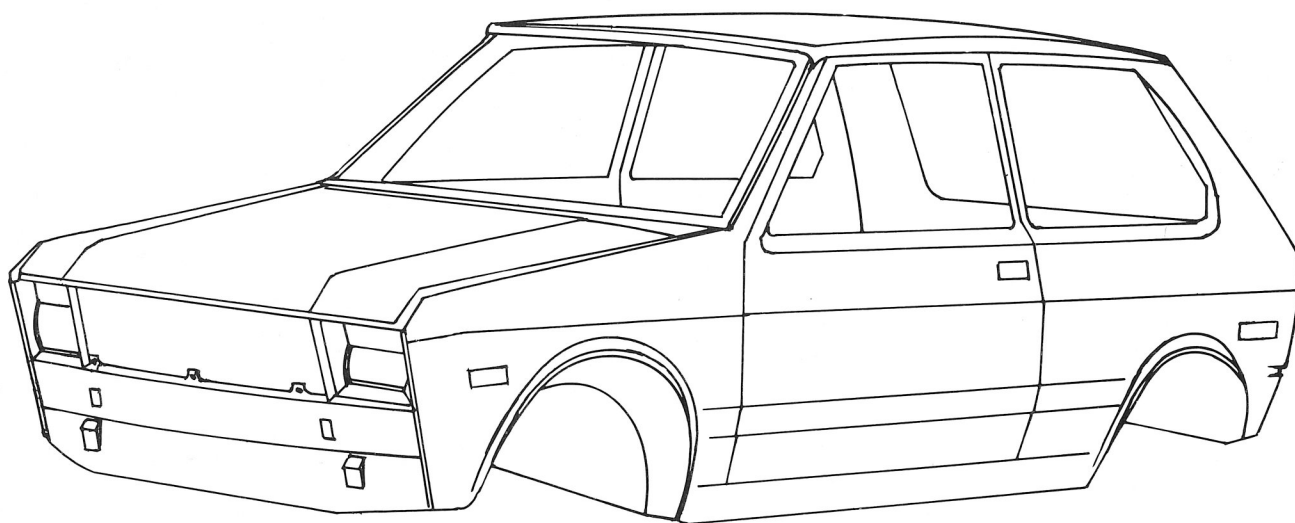
Spare wheel is placed on its bracket inside the engine compartment.

The luggage compartment is behind the back seat. By swinging the cushion and folding the seat back forward, the luggage compartment can be adequately increased. The front seats are of bucket type and can slide forward or backward for convenience. The front seat back is tiltable to provide access to back seats.

Hand grips are fitted at front passenger side and at each side above rear windows in the back. A clothes hook is fitted to each hand grip.

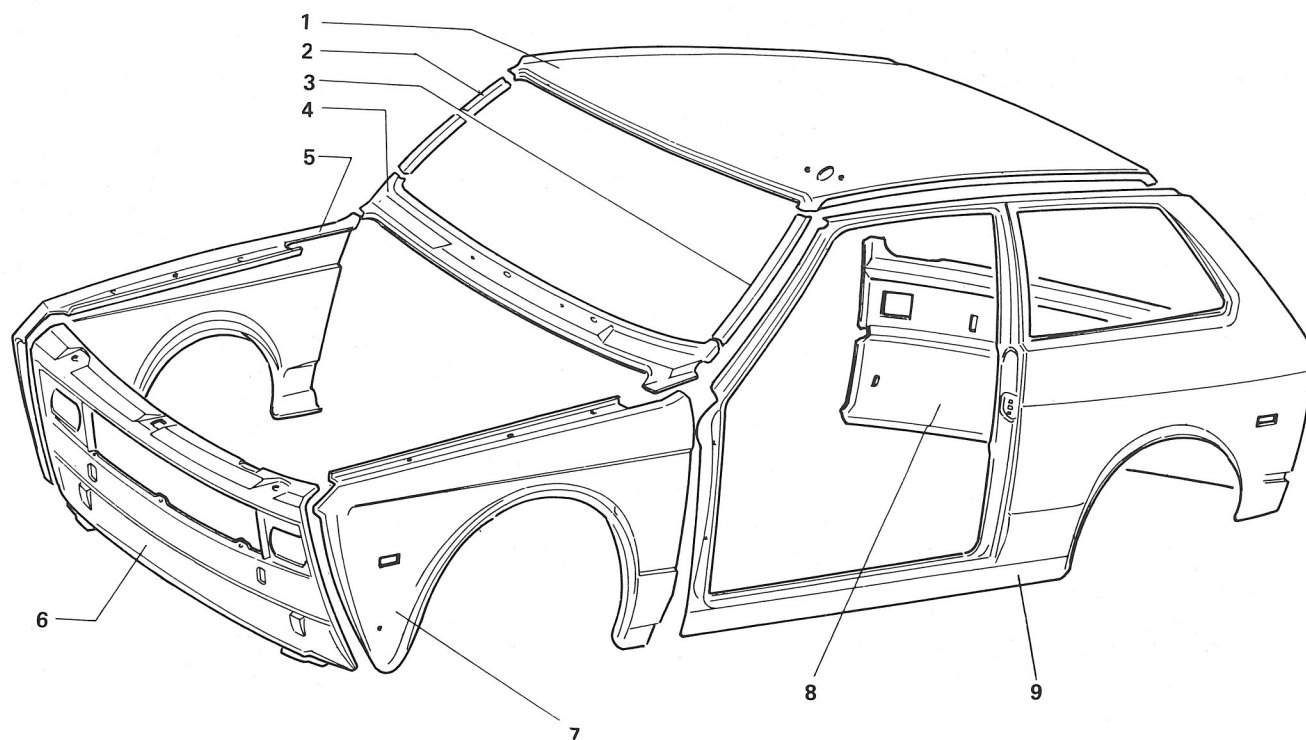
Fuel filler cap is at the right side of the car provided with a lock.

The exterior rear view mirror is fastened at front portion of the driver's door. The interior rear view mirror above the windshield incorporates an anti-glaring device.



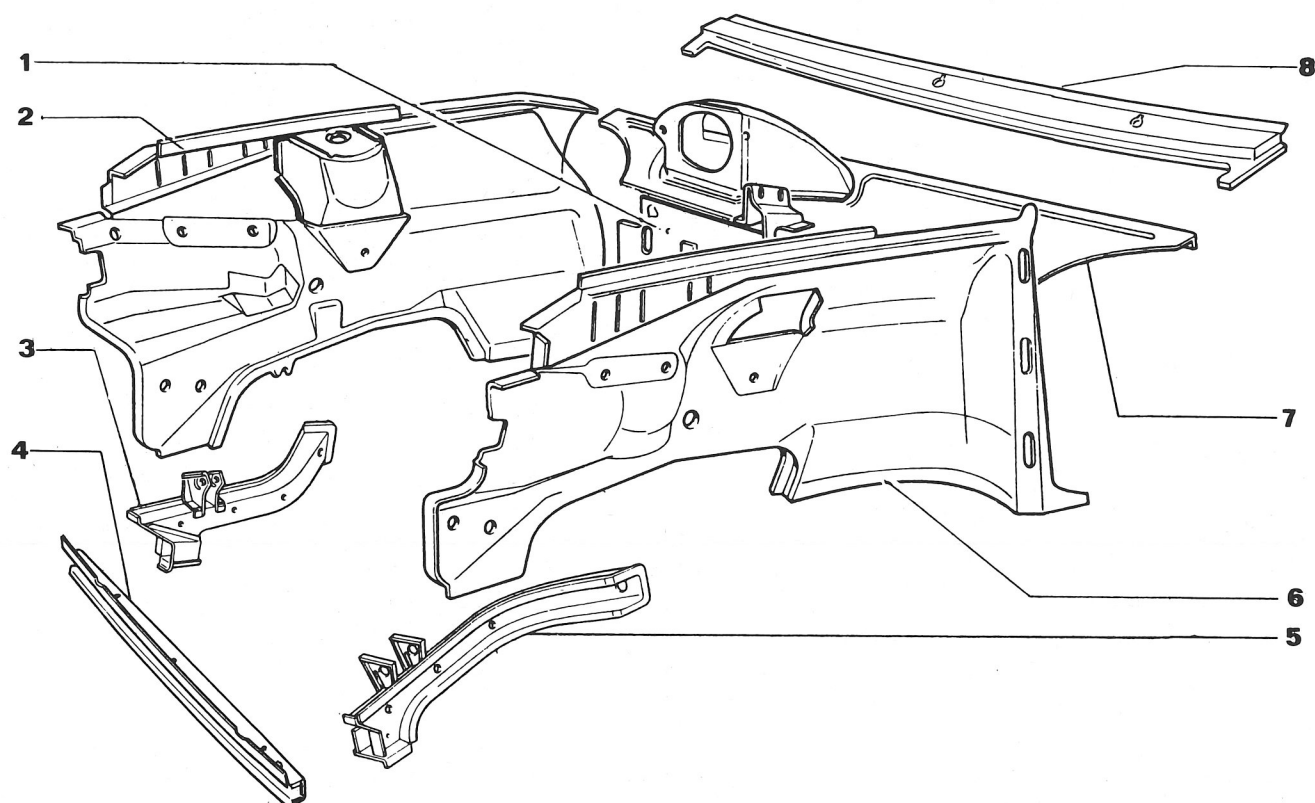
Appearance of body shell

BODY SHELL OUTER ELEMENTS



1. Hard top
2. Pillar
3. Pillar
4. Cowl

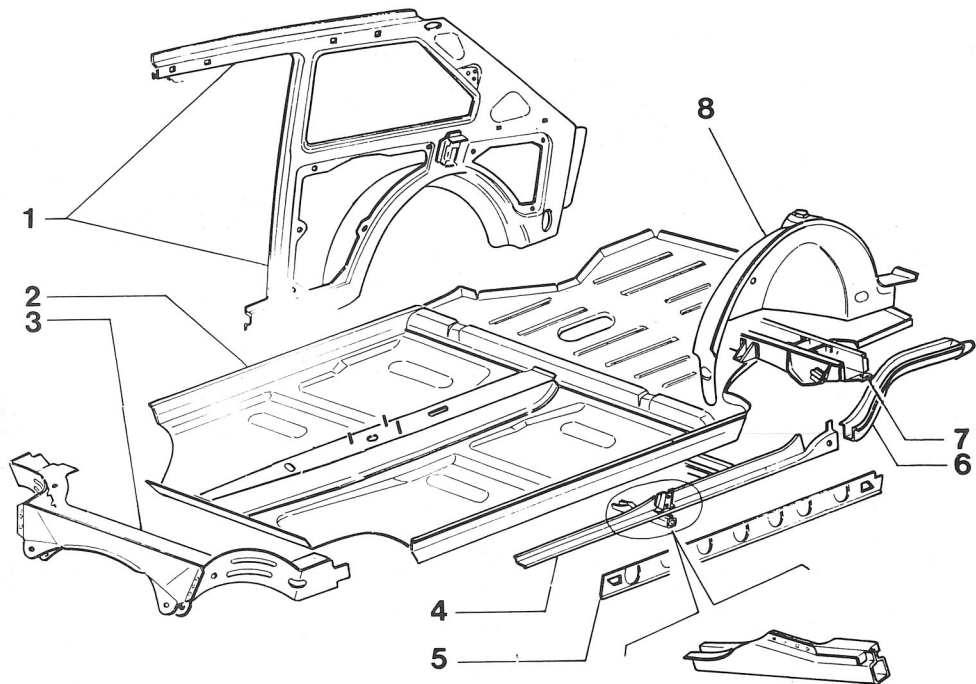
5. Fender, RH front
6. Panel front
7. Fender, LH front
8. Panel rear
9. Quarter panel



1. Firewall
2. Inner fender
3. Box member
4. Crossrall

5. Box member
6. Inner fender
7. Panel - cowl/inner
8. Support - firewall

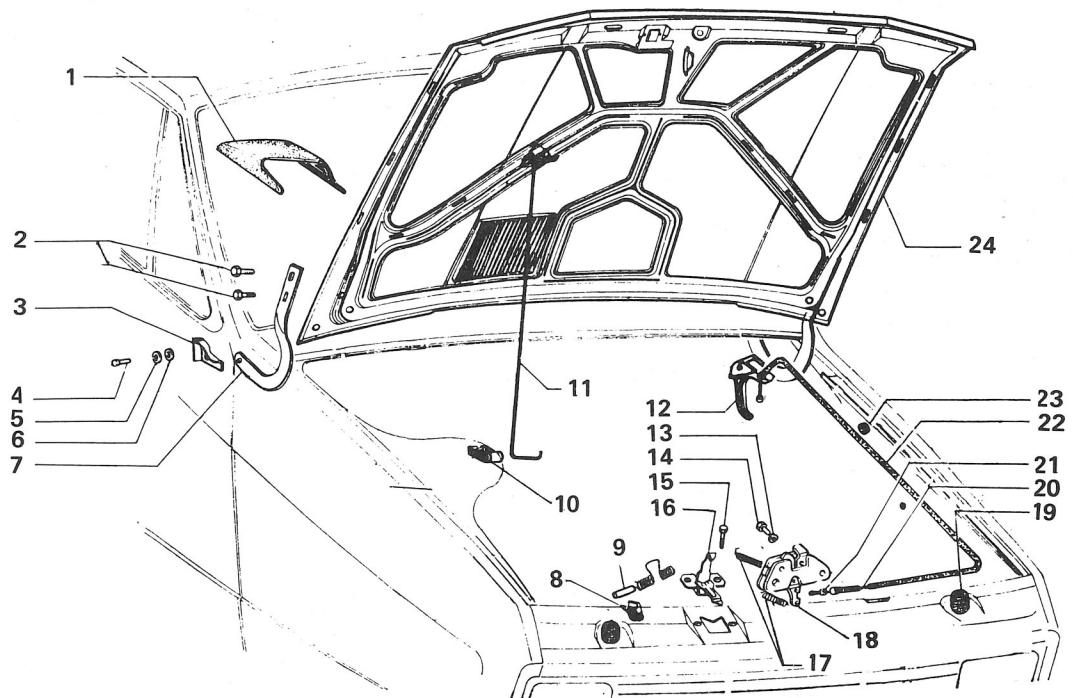
BODY SHELL INNER ELEMENTS



- 1. Panel - inner/quarter
- 2. Floor - pan

- 3. Reinforcement - floor pan
- 4. Rail

- 5. Reinforcement - floor pan
- 6. Support
- 7. Support - inner frame
- 8. Wheelbox



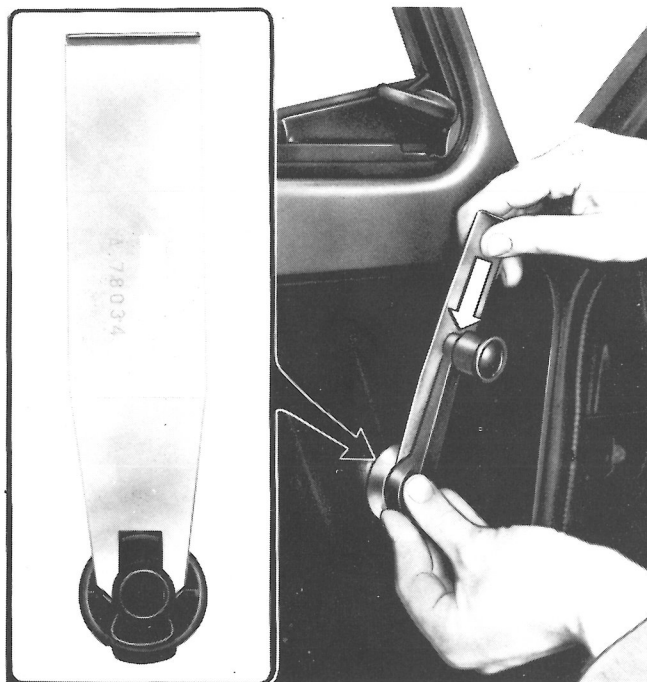
- 1. Scoop
- 2. Bolt
- 3. Hinge
- 4. Bolt
- 5. Lockwasher
- 6. Washer

- 7. Hinge
- 8. Bracket
- 9. Pin
- 10. Bracket
- 11. Hood stay
- 12. Handle

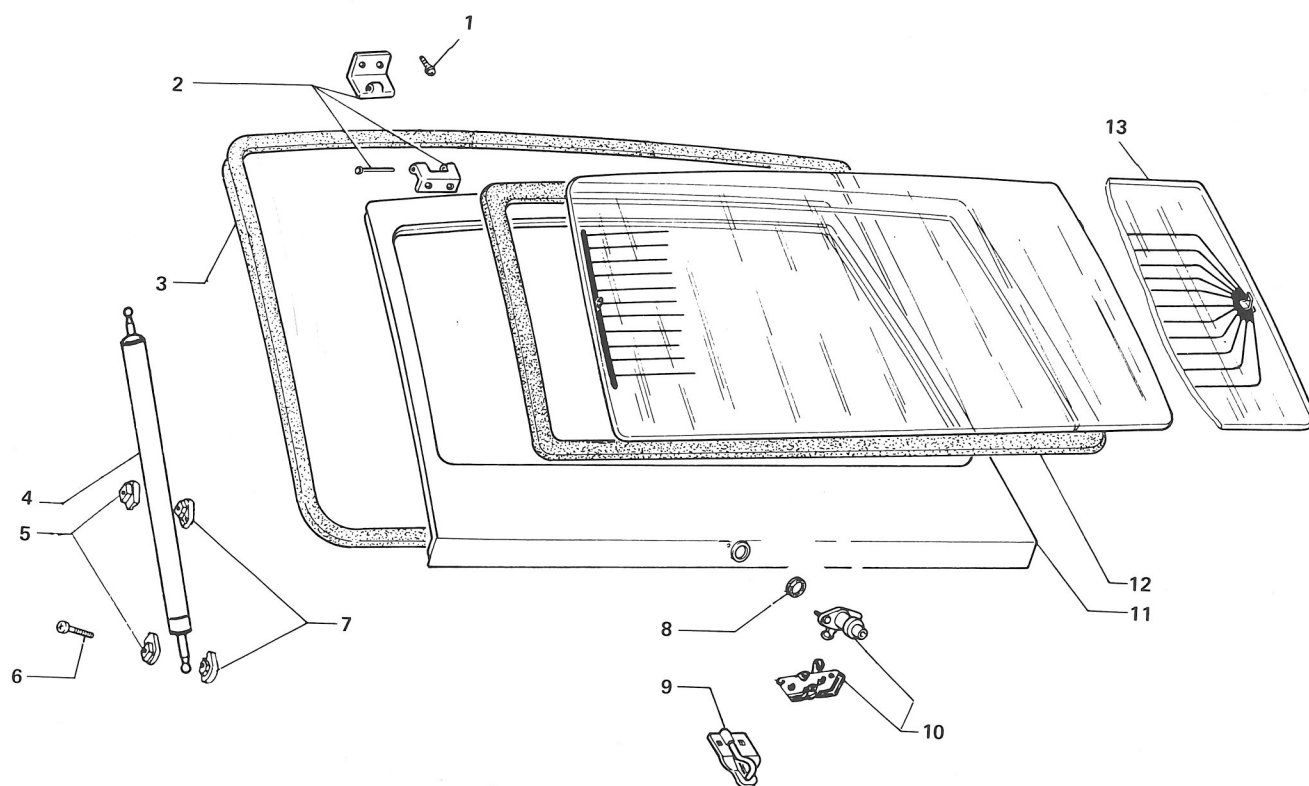
- 13. Lockwasher
- 14. Bolt
- 15. Bolt
- 16. Striker plate
- 17. Springs
- 18. Lock

- 19. Rubber cushion
- 20. Cable
- 21. Pipe
- 22. Housing
- 23. Ring
- 24. Hood

Removal of window crank using tool A, 78034.



HATCH ASSEMBLY

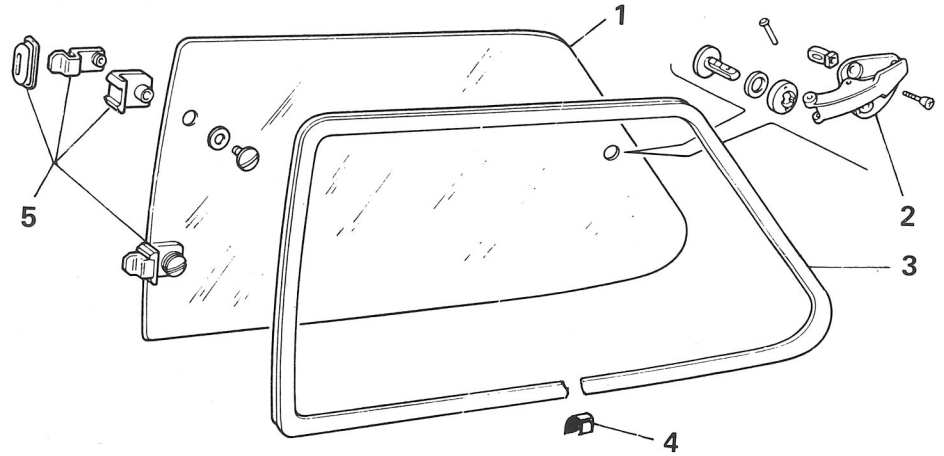


1. Screw
2. Hinge
3. Weatherstrip
4. Strut
5. Strap - grab
6. Screw
7. Strap - grab

8. Ring - lock
9. Striker
10. Lock and latch
11. Hatch panel
12. Weatherstrip
13. Glass

REAR QUARTER WINDOW

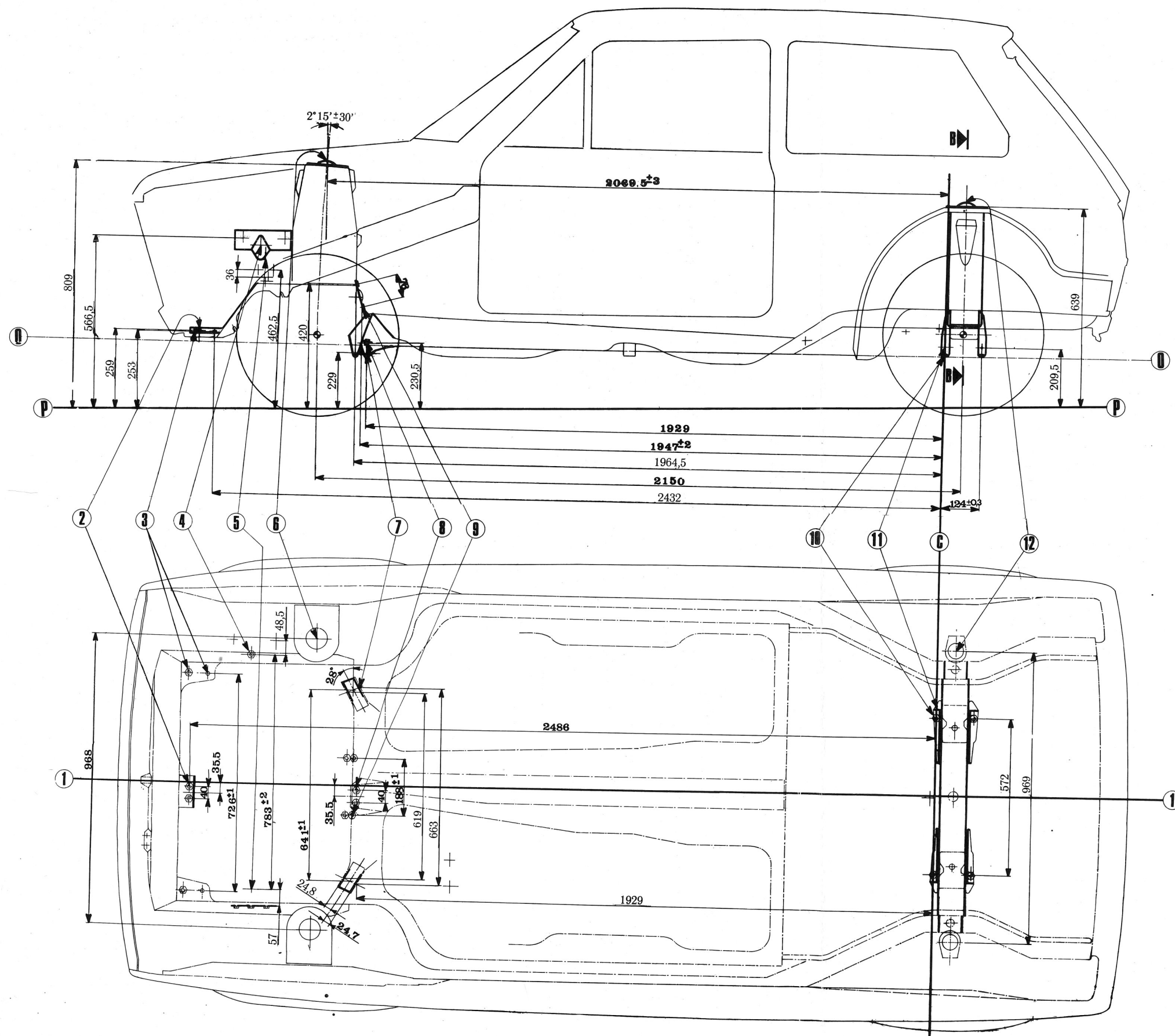
1. Glass
2. Handle
3. Weatherstrip
4. Clip
5. Shield



SERVICE TOOLS

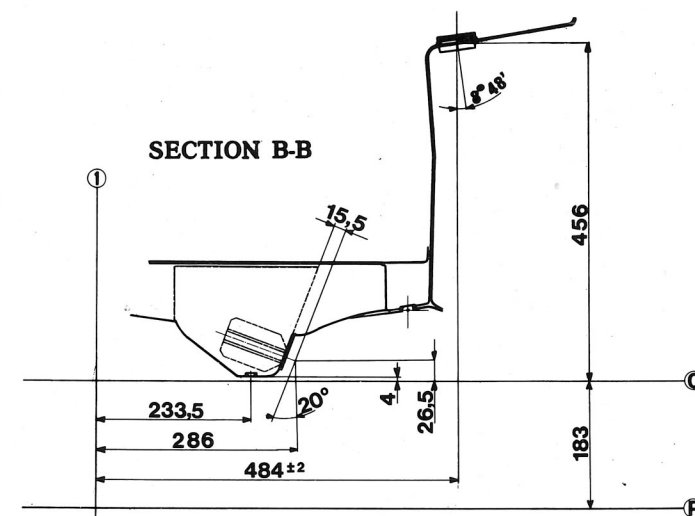


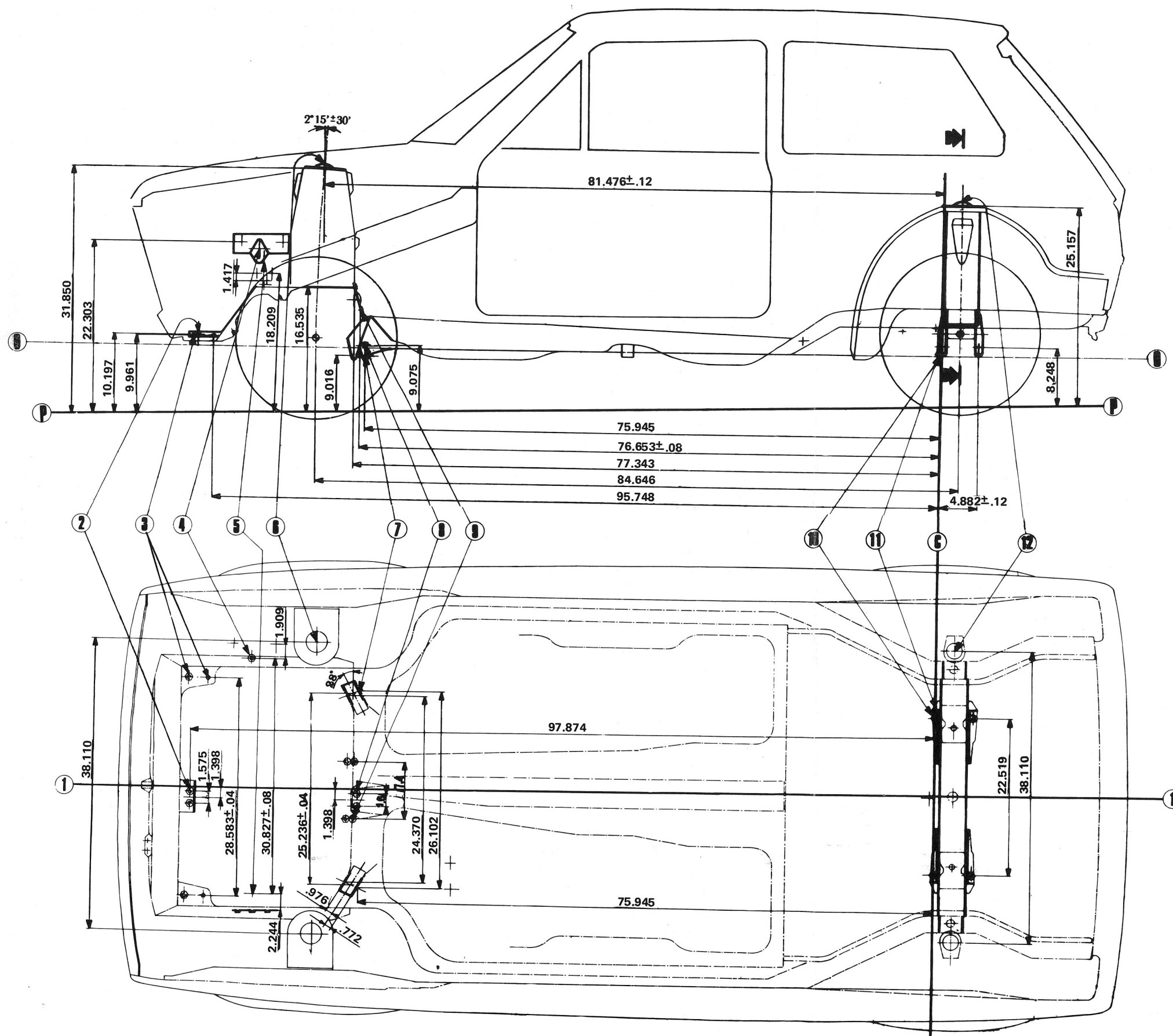
A. 78034 Window crank removal tool



Major dimensions for checking the points used to attack mechanical assemblies

- O. Reference point
- C. Vehicle cross axes
- P. Ground
- 1. Vehicle center line
- 2. Connection of engine rubber mounting and cross member (M8 x 1,25)
- 3. Connection of anti-roll bar (M10 x 1,25)
- 4. Rubber mounting center at engine end for suspending driving unit
- 5. Rubber mounting center at gearbox end for suspending driving unit
- 6. Upper end connection of front shock absorber (\varnothing 56,4 mm)
- 7. Connection of front suspension swinging arm (\varnothing 10,5 mm)
- 8. Connection of rear engine rubber mounting and cross member (M8 x 1,25)
- 9. Connection of steering box (M8 x 1,25)
- 10. Connection of rear suspension swinging arm (\varnothing 10,5 mm)
- 11. Connection of leaf spring support (M6 x 1,25)
- 12. Upper connection of rear shock absorber (\varnothing 30 \pm 0,2 mm)





**Major dimensions for checking the points used to
attach mechanical assemblies**

- O. Reference point
- C. Vehicle cross axes
- P. Ground
- 1. Vehicle center line
- 2. Connection of engine rubber mounting and cross member (M8 x 1,25)
- 3. Connection of anti-roll bar (M10 x 1,25)
- 4. Rubber mounting center at engine end for suspending driving unit
- 5. Rubber mounting center at gearbox end for suspending driving unit
- 6. Upper end connection of front shock absorber 2,2204 in.
- 7. Connection of front suspension swinging arm .413 in.
- 8. Connection of rear engine rubber mounting and cross member (M8 x 1,25)
- 9. Connection of steering box (M8 x 1,25)
- 10. Connection of rear suspension swinging arm .413 in
- 11. Connection of leaf spring support (M6 x 1,25)
- 12. Upper connection of rear shock absorber 1,181 ± .079 in.

